

10. WASTE AREA GROUP 7 (RADIOACTIVE WASTE MANAGEMENT COMPLEX)

Since it began operations in the 1950s, the Radioactive Waste Management Complex (RWMC) has been used to dispose of hazardous and radioactive waste. The RWMC occupies about 177 acres and is divided into three areas: the Subsurface Disposal Area (SDA), the Transuranic Storage Area, and the administration and operations area. This five-year review of the RWMC addresses only cleanup sites within the SDA, which consists of a series of pits and trenches designed for disposal of mixed hazardous substances, including organic waste (e.g., carbon tetrachloride [CCl₄]) and radioactive waste (e.g., transuranic [TRU] waste). The SDA was used to dispose of TRU waste from 1952 to 1970. Disposal of mixed waste was discontinued in 1983.

To facilitate the cleanup of the RWMC, it was designated as Waste Area Group (WAG) 7 under a federal facilities agreement and consent order (FFA/CO) (DOE-ID 1991). Final remedial actions are being implemented at two operable units (OUs) within the SDA: OU 7-08 (which consists of organic contamination in the vadose zone [OCVZ]) and OU 7-12 (which consists of Pad A). In addition, an interim action that is subject to a five-year review is being implemented at OU 7-10 (which consists of Pit 9). Figure 10-1 shows the locations of these OUs.

10.1 Operable Unit 7-08 (Organic Contamination in the Vadose Zone)

From 1954 to 1970, drums of radioactive and organic waste from the Rocky Flats Plant in Colorado were buried in the SDA. Many of these containers have since breached, releasing volatile organic compounds (VOCs) to the vadose zone, which is the 580-ft-thick unsaturated zone that lies beneath the earth's surface but above the Snake River Plain Aquifer (SRPA). These VOCs are primarily in the form of organic vapors that have migrated from the buried waste.

Cleanup of the OCVZ at the SDA is being addressed under OU 7-08. This remedial action is proceeding in accordance with the OU 7-08 record of decision (ROD) (DOE-ID 1994a). Table 10-1 shows the contaminants of concern (COCs) and cleanup goals for the OCVZ.

Table 10-1. COCs at OU 7-08.

Site	COCs	Cleanup Goals ^a
OCVZ	Carbon tetrachloride (CCl ₄)	30 to 200 parts per million by vapor
	Tetrachloroethene (also known as perchloroethylene [PCE])	Not applicable ^a
	Trichloroethene (TCE)	Not applicable ^a
	1,1,1-Trichloroethane (TCA)	Not applicable ^a

a. The OU 7-08 ROD (DOE-ID 1994a) does not specify cleanup goals for PCE, TCE, or 1,1,1-TCA, because these contaminants will be reduced by virtue of CCl₄ treatment. Cleanup goals are being revised and will be published in Revision 2 of the *Data Quality Objectives Summary Report for Operable Unit 7-08 Post-Record of Decision Sampling* (INEEL 2002).

The OU 7-08 ROD lists CCl₄, tetrachloroethene (also known as perchloroethylene [PCE]), trichloroethene (TCE), and 1,1,1-trichloroethane (TCA) as COCs but only lists a cleanup goal for CCl₄, because successful treatment of CCl₄ will also reduce the other COCs. The original estimated volume of CCl₄ buried in the SDA was 325,000 lbs, but that estimate was revised to 1,800,000 lbs in the spring of 2001 based on additional information obtained from the Rocky Flats Plant.

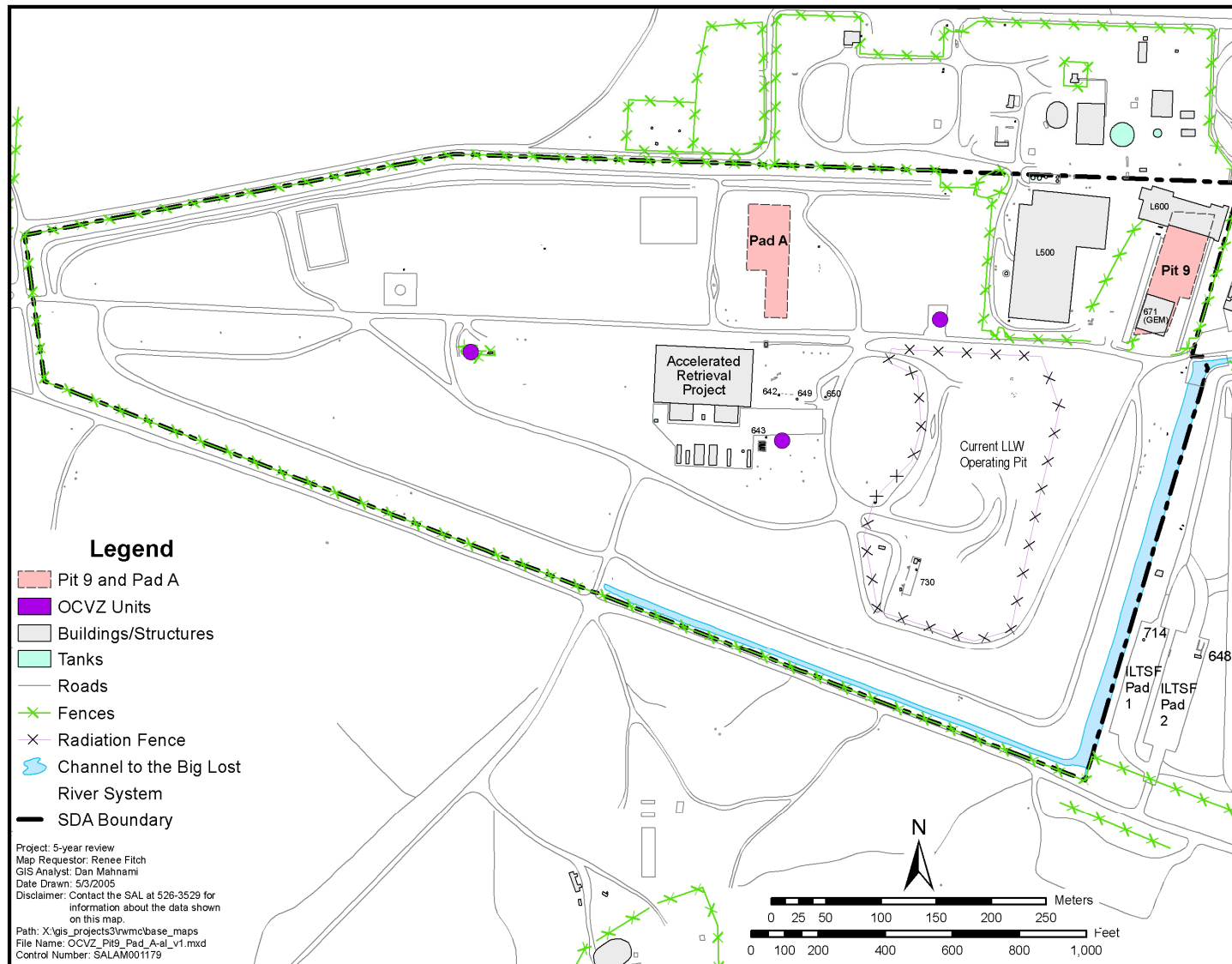


Figure 10-1. Location of OU 7-08 (OCVZ units), OU 7-10 (Pit 9), and OU 7-12 (Pad A) at the RWMC.

CCl₄ has been detected in the SDA surficial sediments, vadose zone soil gas, vadose zone soil water (perched water and lysimeters), and the SRPA beneath and surrounding the SDA. Through the use of surface isolation flux chambers, CCl₄ vapor has been detected emanating from the soil surface. In 1987, CCl₄ was also detected in the SRPA above maximum contaminant levels (MCLs).

Since 1996, treatment units have been used to destroy contaminants in vapor extracted from various wells in the vadose zone. Early units used recuperative flameless thermal oxidation (RFTO) to destroy VOCs. Newer OCVZ units utilize catalytic oxidation. Monitoring indicates that concentrations of VOCs are decreasing throughout the vadose zone.

Table 10-2 provides a chronology of significant events at OU 7-08.

Table 10-2. Chronology of OU 7-08 events.

Event	Date
The RWMC was established.	1950
TRU waste was buried at the SDA. Associated with the TRU waste were large quantities of VOCs.	1952–1970
A shallow gas survey identified VOCs in the subsurface.	1987
CCl ₄ was detected above the MCL in the SRPA south of the SDA.	1987
The Idaho National Laboratory (INL) Site received its final listing on the National Priorities List (54 FR 29820).	November 21, 1991
The FFA/CO for the INL Site was signed (DOE-ID 1991).	December 9, 1991
Subsurface vapor samples from monitoring wells at the RWMC revealed the extent and concentration of contaminants in the subsurface.	July 1992–March 1993
The remedial action and feasibility study was completed for OCVZ.	1993
The OU 7-08 ROD (DOE-ID 1994a) was signed.	December 2, 1994
The pre-final inspection of the RFTO units was completed.	December 1995
The baseline subsurface vapor sampling was completed.	January 4, 1996
RFTO Units A, B, and C were started.	January 1996
The first failure of RFTO Unit C occurred. The unit was rebuilt.	September 1998
The final failure of RFTO Unit C occurred.	May 14, 2000
The inventory of VOCs was revised upward.	2001
Catalytic oxidation Unit D replaced RFTO Unit C.	July 2001
Unit D began continuous operation.	January 2002
The first five-year review of the OCVZ remedy was completed.	August 18, 2003
Unit B was replaced with catalytic oxidation Unit F.	March 2004
Unit A was replaced with catalytic oxidation Unit E.	April 2004
Unit E was relocated.	March 2005

10.1.1 Remedial Actions

10.1.1.1 Remedy Selection. The OU 7-08 ROD (DOE-ID 1994a) summarized the site assessment and identified the selected remedy—i.e., extraction from and destruction of organic contaminants in the vadose zone beneath and in the immediate vicinity of the RWMC where organic contaminants exist in a vapor state. The selected remedy does not include the waste remaining in the disposal pits. The selected remedy that is specified in the ROD also includes monitoring of the vadose zone vapor and the SRPA.

The general objective of the selected remedy was to reduce the risks posed to human health and the environment from organic contaminants in the vadose zone and to prevent federal and state drinking water standards from being exceeded after the 100-year institutional control period, as defined in DOE M 435.1-1, *Radioactive Waste Management Manual*.

The ROD (DOE-ID 1994a) stated that the major components of the selected remedy would include the following:

- Installing and operating five vapor extraction wells (in addition to an existing vapor extraction well) at the RWMC as part of a first-phase effort to extract organic contaminant vapors from the vadose zone. The selected remedy includes options to expand the number of vapor extraction wells for potential second and third phases. Additional system modifications will be evaluated with each phase transition.
- Installing and operating off-gas treatment systems to destroy the organic contaminants in the vapor that is removed from the extraction wells. Off-gas treatment will be in the form of catalytic oxidation or an equally effective organic contaminant destruction technology.
- The addition of soil vapor monitoring wells to monitor the performance of the vapor extraction wells and verifying the attainment of remedial action objectives (RAOs). Soil vapor monitoring will also provide information to evaluate potential modifications to the selected remedy to continue beyond the first phase. The expected duration of the first phase is approximately two years; potential second and third phases would operate for approximately two years each. The actual duration of each phase is dependent on elements such as equipment procurement and installation that may be involved with each potential phase transition.
- The maintenance of institutional controls, which includes: using signs, restricting access, maintaining fences/barriers, and monitoring the existing production well supplying water to workers at the RWMC. It is presumed that this level of institutional control will be maintained at the RWMC through the year 2091.

The ROD also stated that organic waste remaining in the pits could extend the time needed to achieve RAOs using the selected remedy, because the remaining organic waste could act as a “long-term” source of organic contamination in the vadose zone. Once the remedy was implemented, it became apparent that the “phases” would last more than two years, because the remedy does not include removal or treatment of the buried waste. Removal or treatment of the remaining buried organic waste, which is the long-term source of the contamination, could reduce the time needed to reach remediation goals using the current OCVZ system. In 2004, the Accelerated Retrieval Project (Figure 10-1) began limited excavation and retrieval of selected waste streams from a designated area in the SDA—a 1/2-acre plot in the eastern portion of the SDA’s Pit 4. The OCVZ Project, though not directly affiliated with Accelerated Retrieval Project, will benefit by the reduction of the organic source term in the SDA.

10.1.1.2 Remedial Action Objectives. The OU 7-08 ROD concluded that extraction and destruction of organic vapors from the vadose zone beneath the SDA would reduce direct exposure to the contaminants. Although the OU 7-08 ROD specifies cleanup goals for vapor in the vadose zone and does not specifically address cleanup of the SRPA, the objective of this remedial action is to prevent the migration of contaminants to the SRPA and keep them below federal and state MCLs after a 100-year period. MCLs for the various organic compounds are the preliminary remediation goals for protection of the SRPA, which will be addressed in the OU 7-14 ROD. The OCVZ remedial action ensures protection of human health and the environment. The decision to implement this remedial action was based on the results of human-health and ecological-risk assessments.

10.1.1.3 Remedy Implementation. To implement the selected remedy described in the OU 7-08 ROD, three RFTO units were installed within the SDA (Wilkening 2003). Operation of the RFTO units began in 1996. Units A and B were designed to extract and treat vapors from two wells each. Unit C was designed to extract and treat vapors from one well. During the spring of 2001, Unit C was decommissioned and removed from the SDA. Unit D, an electrically heated catalytic oxidizer, was installed at the previous Unit C location, began operating in July 2001, and was brought up to full-scale operation in March 2002. In February 2003, Unit B was decommissioned followed by Unit A in late September 2003. Units E and F, both electrically heated catalytic oxidizers, replaced Units A and B and became operational during the spring of 2004. On January 6, 2004, Unit F was started for testing and began full-scale operation on March 15, 2004. Unit E was started for testing on March 23, 2004, and began full-scale operation on April 6, 2004.

In 2000 and 2001, four wells were installed inside the SDA to support OU 7-08. These wells include a groundwater monitoring well, M17S, and three vapor extraction wells, DE1 (480 ft below land surface [bls]), 7E (±10 ft bls), and 6E (±10 ft bls). Well DE1 also provides vapor monitoring.

Fourteen new wells were installed during 2002 and 2003 to support the OU 7-08 remedial action. These wells were completed as vapor extraction wells or as a combination of monitoring and extraction wells. The locations of the wells are shown in Figure 10-2. They were installed in clusters of three wells, one well having a shallow extraction (SE) interval located above the B-C interbed (i.e., ±10 ft bls), one well having an intermediate extraction (IE) interval located between the B-C interbed (i.e., ±10 ft bls) and the C-D interbed (i.e., 240 ft bls), and one well having a deep extraction (DE) interval located below the C-D interbed (i.e., 240 ft bls). The new wells—SE3, IE3, DE3, IE4, DE4, SE6, IE6, DE6, SE7, IE7, DE7, SE8, IE8, and DE8—were installed in five distinct locations based primarily on proximity to buried organic waste.

Vapor sampling occurs at 174 monitoring ports (Figure 10-2). Monthly sampling is conducted at 141 of these monitoring ports, and all 174 monitoring ports are sampled quarterly. Vapor is being extracted from the vadose zone at the SDA and treated at 20 extraction wells. Table 10-3 shows the contaminants removed from the vadose zone as of the end of 2004.

10.1.2 Data Evaluation

As mentioned above, the OU 7-08 ROD addresses cleanup of the vadose zone rather than contaminants in the SRPA. However, the ROD does require groundwater sampling, because such sampling indicates the effectiveness of the OCVZ Project in containing and removing contamination before it reaches the SRPA.

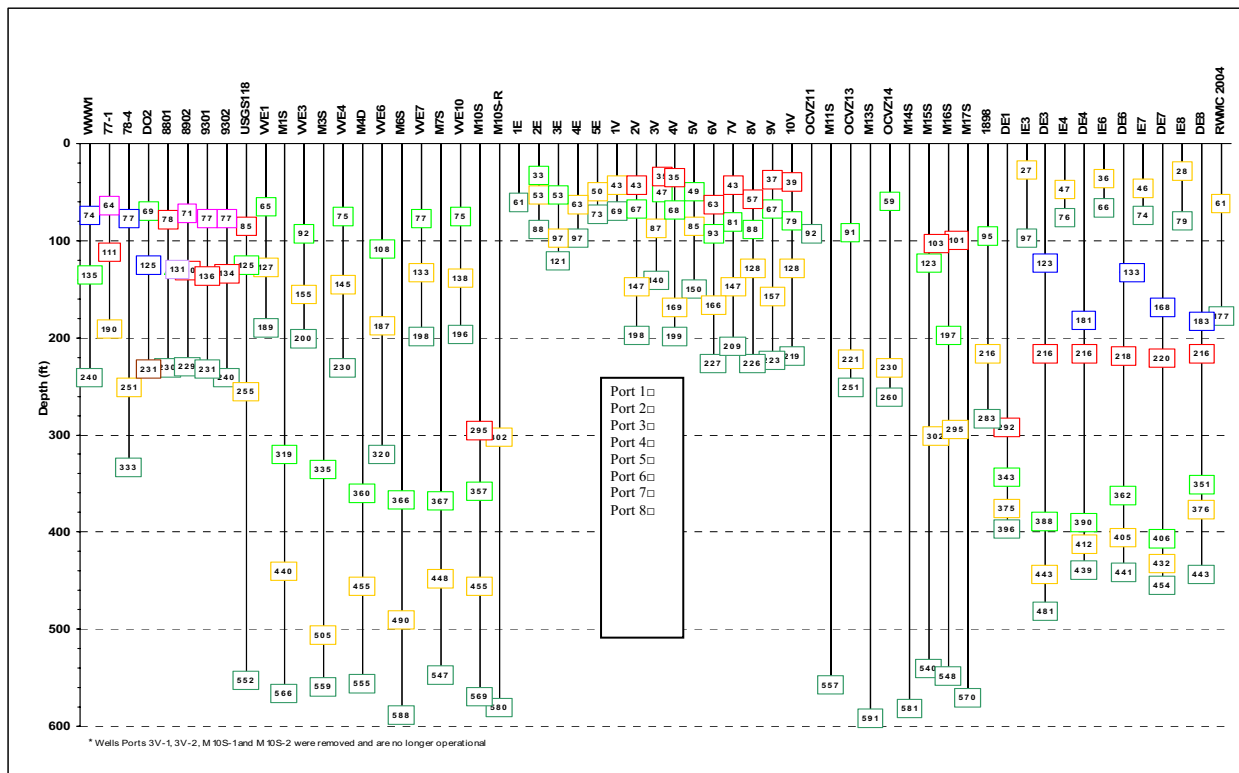
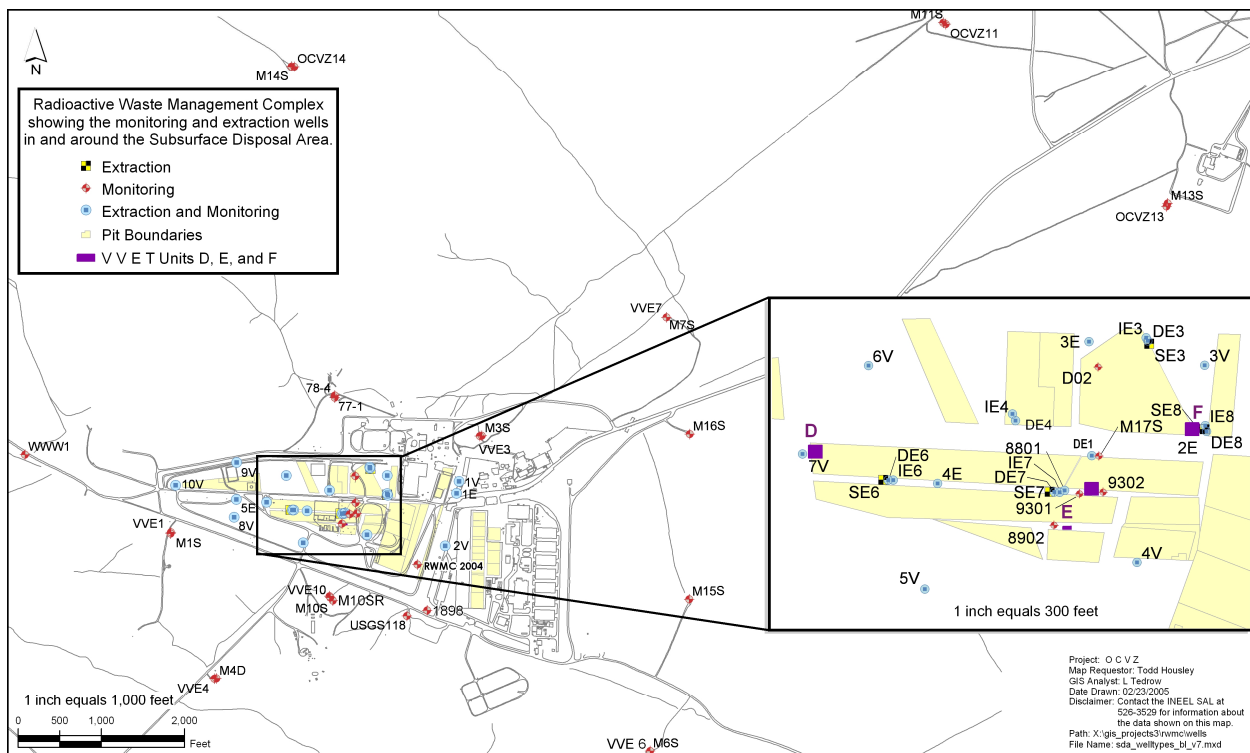


Figure 10-2. Location and depth of vapor sampling ports in and around the SDA.

Table 10-3. Breakdown by operating cycle of the mass of contaminants removed to date.

Operating Period	Year	CHCl ₃ (lb)	TCA (lb)	PCE (lb)	TCE (lb)	CCl ₄ (lb)	Total (lb)
1st 8 weeks	1996	1001	277	183	855	4447	6,763
% of total		15%	4%	3%	13%	66%	
2nd 8 weeks	1996	671	209	168	646	3090	4,784
% of total		14%	4%	4%	14%	65%	
3rd 8 weeks	1996	501	149	104	449	2211	3,413
% of total		15%	4%	3%	13%	65%	
1st quarter	1997	443	108	62	320	1938	2,871
% of total		15%	4%	2%	11%	68%	
2nd quarter	1997	1078	360	294	1076	5191	7,999
% of total		13%	5%	4%	13%	65%	
3rd quarter	1997	643	119	145	604	2800	4,311
% of total		15%	3%	3%	14%	65%	
4th quarter	1997	1202	342	241	987	5391	8,162
% of total		15%	4%	3%	12%	66%	
Midyear	1998	1083	339	247	967	4757	7,393
% of total		15%	5%	3%	13%	64%	
End-Year	1998	1452	376	412	1537	5942	9,719
% of total		15%	4%	4%	16%	61%	
Midyear	1999	745	196	149	808	3725	5622
% of total		13%	3%	3%	14%	66%	
End-Year	1999	1149	367	320	1337	5492	8664
% of total		13%	4%	4%	15%	63%	
Midyear	2000	1125	302	272	1252	5119	8072
% of total		14%	4%	3%	16%	63%	
End-Year	2000	630	128	69	567	2934	4,329
% of total		15%	3%	2%	13%	68%	
Midyear	2001	1534	272	326	1349	6153	9634
% of total		16%	3%	3%	14%	64%	
End-Year	2001	1720	513	332	1849	7349	11763
% of total		15%	4%	3%	16%	62%	
Midyear	2002	2061	966	517	2377	7845	13767
% of total		15%	7%	4%	17%	57%	
End-Year	2002	2412	1016	535	2516	8477	14956
% of total		16%	7%	4%	17%	57%	
Midyear	2003	2134	975	603	2379	8151	14242
% of total		15%	7%	4%	17%	57%	
End-Year	2003	765	290	164	740	2388	4347
% of total		18%	7%	4%	17%	55%	
Midyear	2004	3495	1384	745	3505	12356	21486
% of total		16%	6%	3%	16%	58%	
End-Year	2004	3180	1230	1062	3042	10919	19433
% of total		16%	6%	5%	16%	56%	
Total 1996-2004							191,730

Data from a number of monitoring wells in the RWMC area were reviewed for VOC concentrations in groundwater. CCl₄ is the most common VOC detected in the groundwater samples over the past five years, with consistent positive detections in approximately half of the monitoring wells in the monitoring network. Several wells are currently near or above the MCL of 5 g/L; these wells include M7S, M16S, A11A31, and the RWMC production well. Detections of other VOC contaminants in the monitoring wells are much less frequent, with occasional detections of TCE (in the RWMC production well at 0.3 g/L in 2003) and methylene chloride (in well M1S in 2002 and in the associated blank). All positive detections of these contaminants were well below their respective MCLs. Aquifer water samples collected at the RWMC are analyzed for other VOCs in addition to CCl₄, PCE, and methylene chloride, and most of the samples were nondetections in fiscal year 2003. Chloroform, TCE, toluene, and 1,1,1-TCA were the only compounds detected at concentrations above the quantitation limit (WAG 7) or minimum reporting level (United States Geological Survey [USGS]). All compounds were below the respective MCLs. Samples were analyzed for 54 other organic compounds, but none of them was detected above the quantitation limit (WAG 7) or minimum reporting level (USGS).

Figure 10-3 shows the concentration history of CCl₄ in aquifer wells in the vicinity of the RWMC. The following observations can be made by comparing the time trends in the concentration data spatially:

- A few of the wells northeast of the RWMC exhibit a generally persistent increasing concentration trend. These wells are M7S, USGS-87, and the RWMC production well. Since approximately 1997, however, the data indicate a decline in the rate of increase in M7S and the RWMC production well. USGS-90 showed an increasing concentration trend until it was last sampled in April 1999, after which the pump became inoperable. Because USGS-90 has not been sampled since that time, further trends cannot be observed in the well. Data from other wells might also be interpreted as showing increasing concentrations of CCl₄ but to a much lesser extent than the wells discussed previously. Wells with possible increasing concentrations include M3S, M15S, and M16S, whose data are either highly variable or of short duration.
- Wells to the southwest generally show flat or decreasing concentration trends. CCl₄ is not routinely detected in most of the wells in this area; these wells include M1S, OW-2, USGS-89, USGS-117, and USGS-119. Several other wells, including M6S and USGS-88, show either flat or decreasing trends.
- Wells USGS-120 and A11A31—located approximately 4,000 and 5,000 ft south of the RWMC, respectively—require a separate discussion. CCl₄ concentrations in USGS-120 were less than 2 parts per billion (ppb) from 1987 to 1997. Then, from 1997 to 1999, the concentrations increased slightly above the MCL and remained as such for two years. Since 2001, however, the concentrations have decreased and are currently at about 3 ppb. Concentrations in Well A11A31 have regularly been above the MCL since approximately 2001, but results from the last three quarters have been below the MCL. The considerable distance to both of these wells from the RWMC area and the consistent positive detections of CCl₄ make estimating the total extent of contamination in the SRPA difficult. Sitewide (i.e., WAG 10) groundwater monitoring conducted has not detected CCl₄ in the southern boundary wells (USGS-009, -015, and -109) using standard analysis techniques.

10.1.3 Progress since Last Review

Since the last five-year review (i.e., 2003), additional wells have been installed, the reliability of the treatment units has improved, downtime has been reduced, and data acquisition in deeper zones has improved. Additionally, the operations and maintenance plan (ICP 2004a) has been revised, improving the monitoring of exhaust gases.

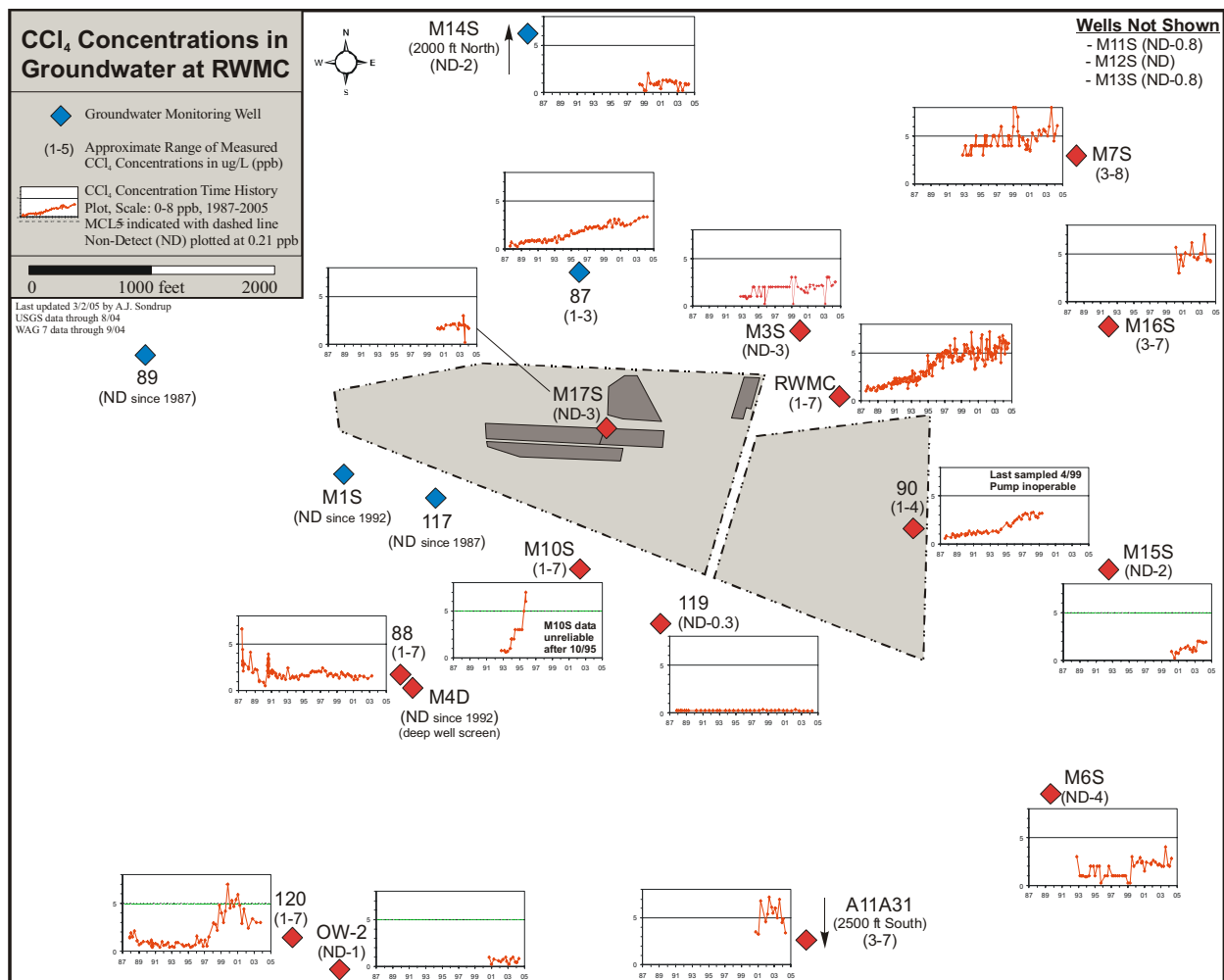


Figure 10-3. CCl_4 concentrations in aquifer monitoring wells in the vicinity of the RWMC.

The mass of total VOCs removed each year increased significantly in 2004 (Figure 10-4) after a period of decommissioning and installation of new units—activities that consumed much of 2003. The VOC concentrations of samples taken from ports on the inlet lines (downstream of the ambient air intake valves) to the OCVZ units were used to calculate mass removal rates. Samples have been taken daily during the normal operations workweek (i.e., Monday through Thursday), and the results are averaged between sampling events. Actual operating hours and average unit operation parameters (i.e., flow rate, pressure, and temperature) were used for the mass removal calculations (EDF-2157). Results show that approximately 192,000 lbs of total VOCs have been removed from the SDA during the period from January 1996 through December 2004.

In general, CCl_4 concentrations in the monitoring wells are decreasing (Figures 10-5 through 10-13). The sampling events range in time from before the remedial action started in 1996 through 2004. CCl_4 is the largest contributor to the mass removal of VOCs, with 61% of the total. General trends show a decreasing areal extent of the plume of VOCs. The prevailing long-term trends indicate that overall VOC concentrations are decreasing above the B-C interbed (i.e., ± 10 ft bls) when compared to data collected at the same depth before operations.

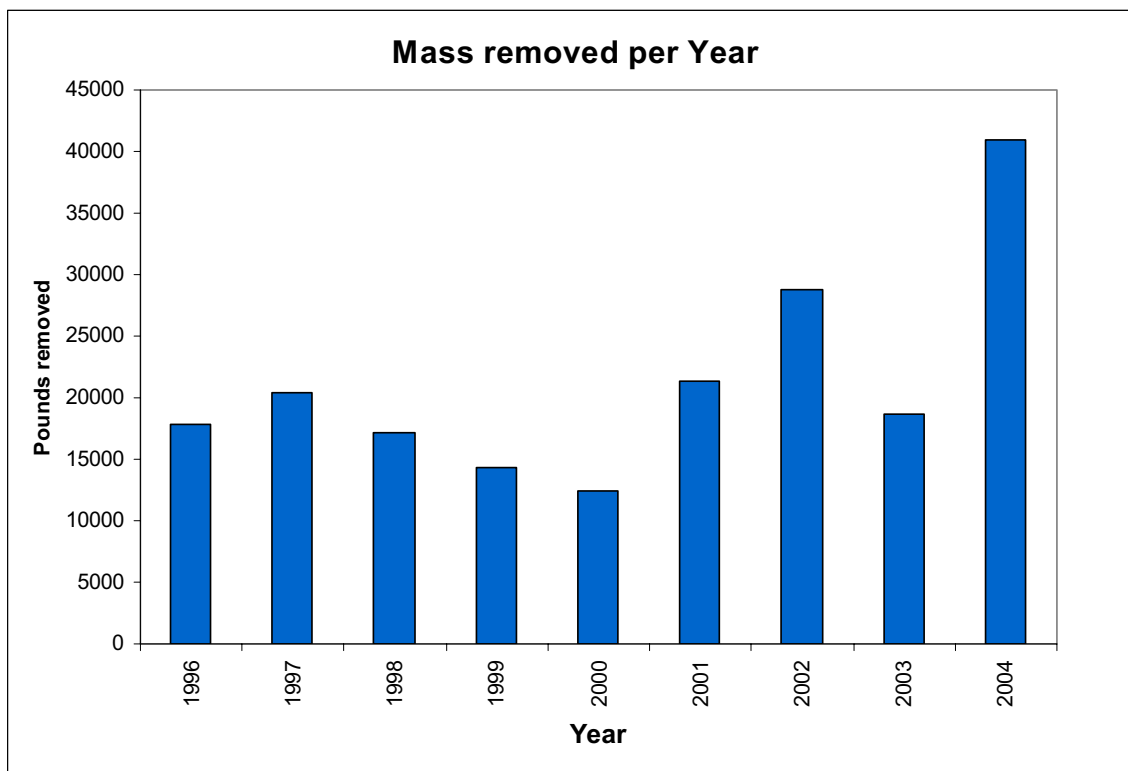


Figure 10-4. Total mass of VOCs removed during each year of OCVZ operation.

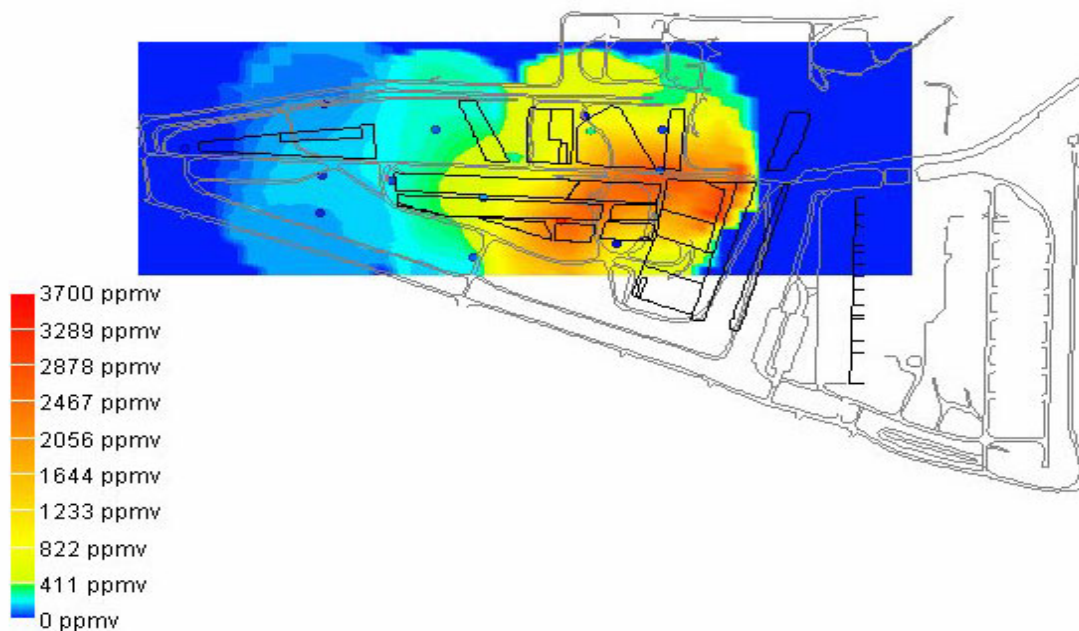


Figure 10-5. Spatial distribution of CCl_4 in the SDA at approximately 70 ft bls in January 1996 (ICP 2004b).

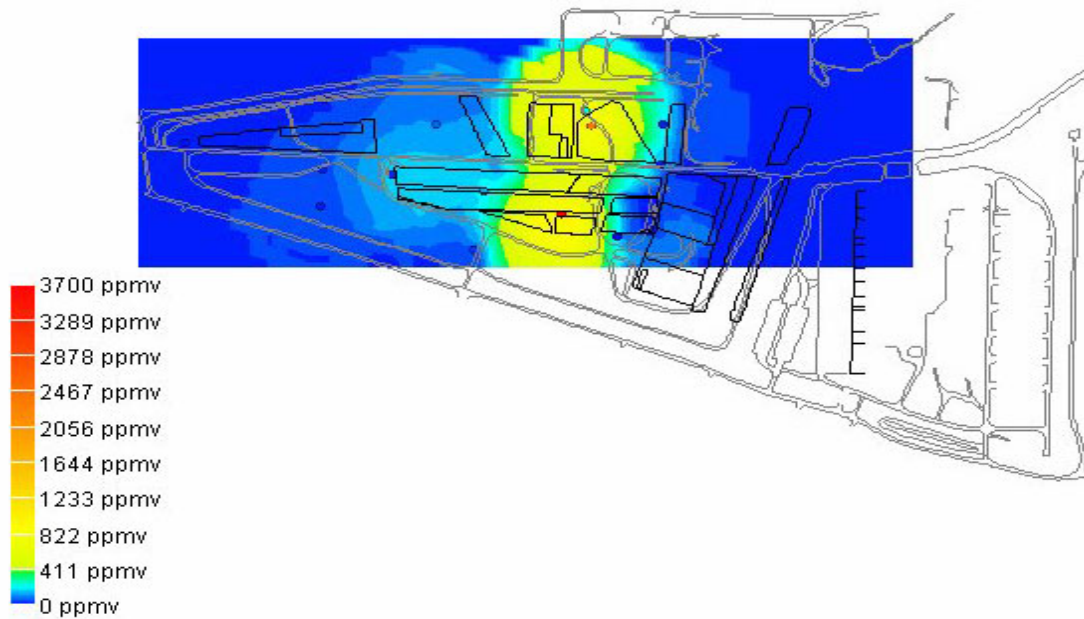


Figure 10-6. Spatial distribution of CCl_4 in the SDA at approximately 70 ft bls in January 1998 (ICP 2004b).

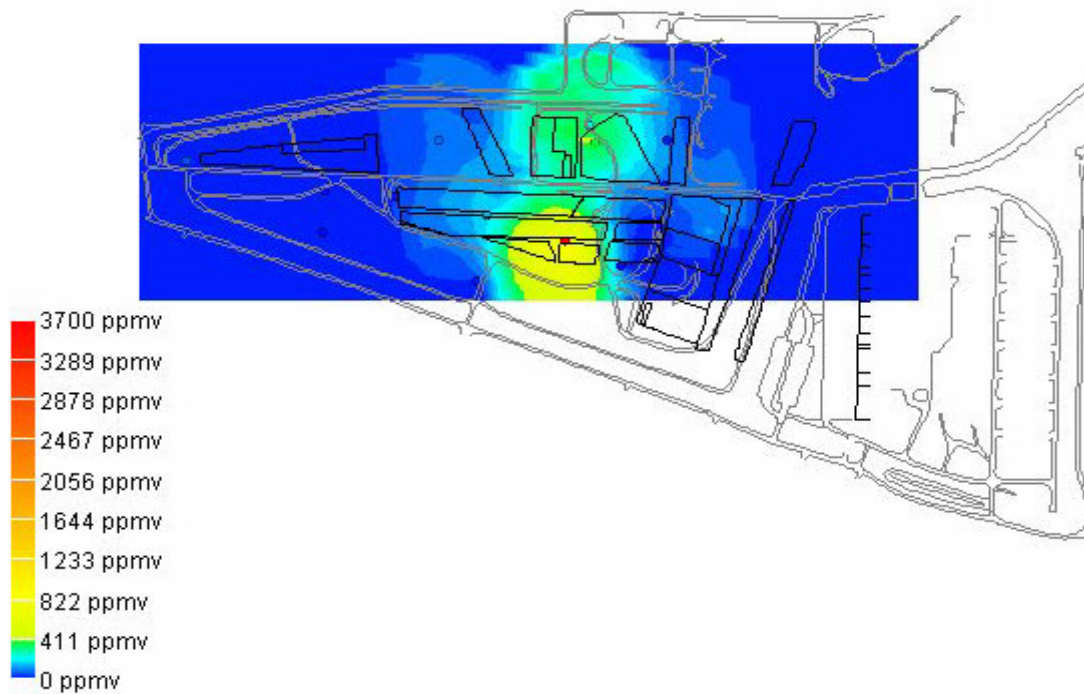


Figure 10-7. Spatial distribution of CCl_4 in the SDA at approximately 70 ft bls in January 2000 (ICP 2004b).

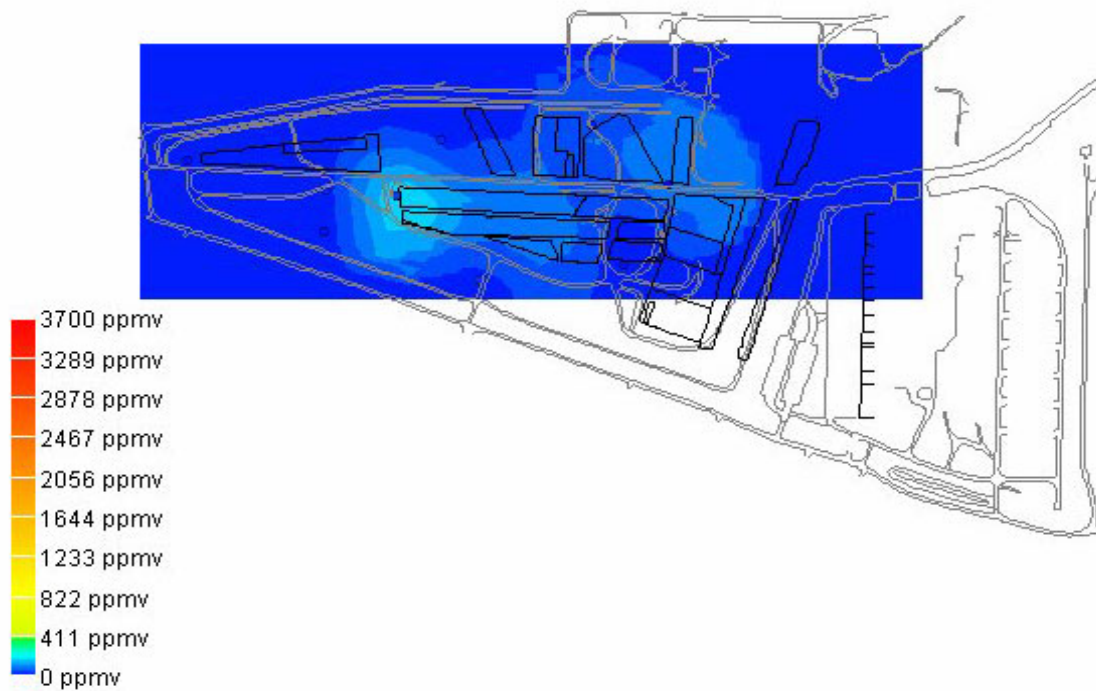


Figure 10-8. Spatial distribution of CCl_4 in the SDA at approximately 70 ft bls in January 2002 (ICP 2004b).

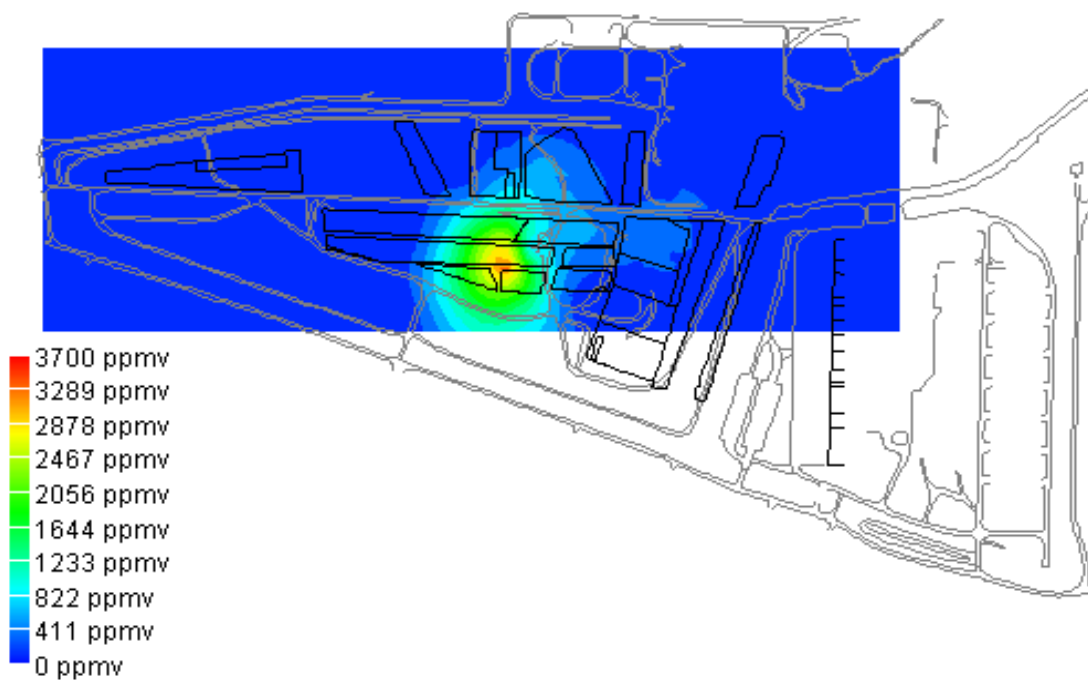


Figure 10-9. Spatial distribution of CCl_4 in the SDA at approximately 70 ft bls in October 2003 (ICP 2004b).

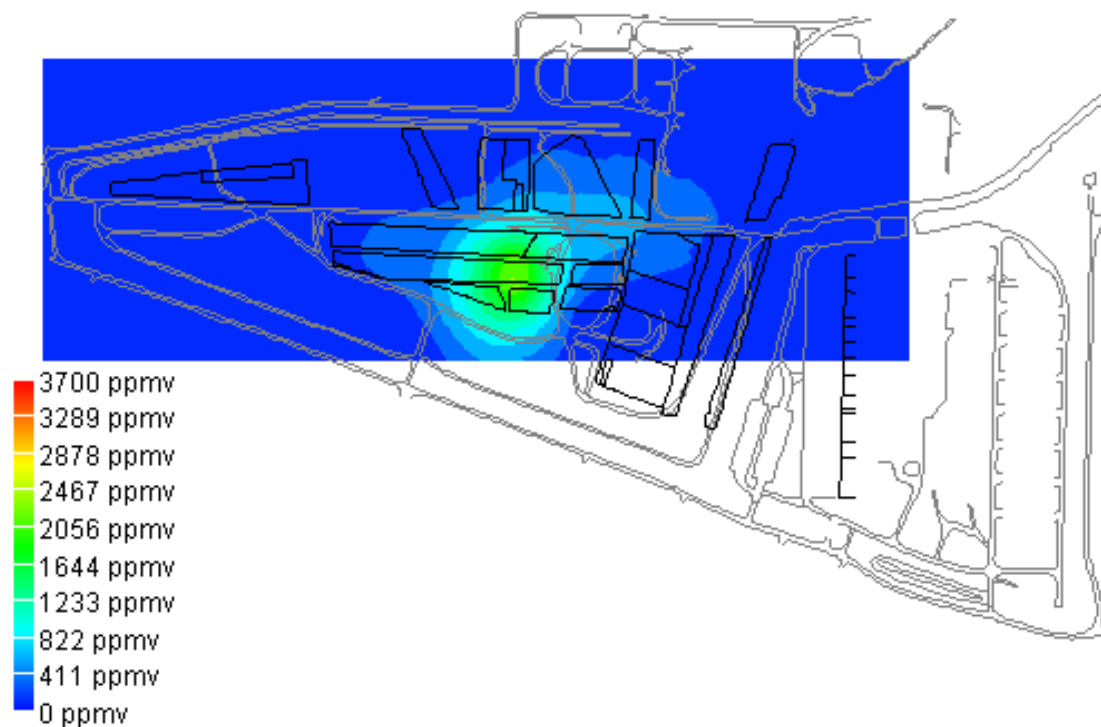


Figure 10-10. Spatial distribution of CCl_4 in the SDA at approximately 70 ft bls in January 2004 (ICP 2004b).

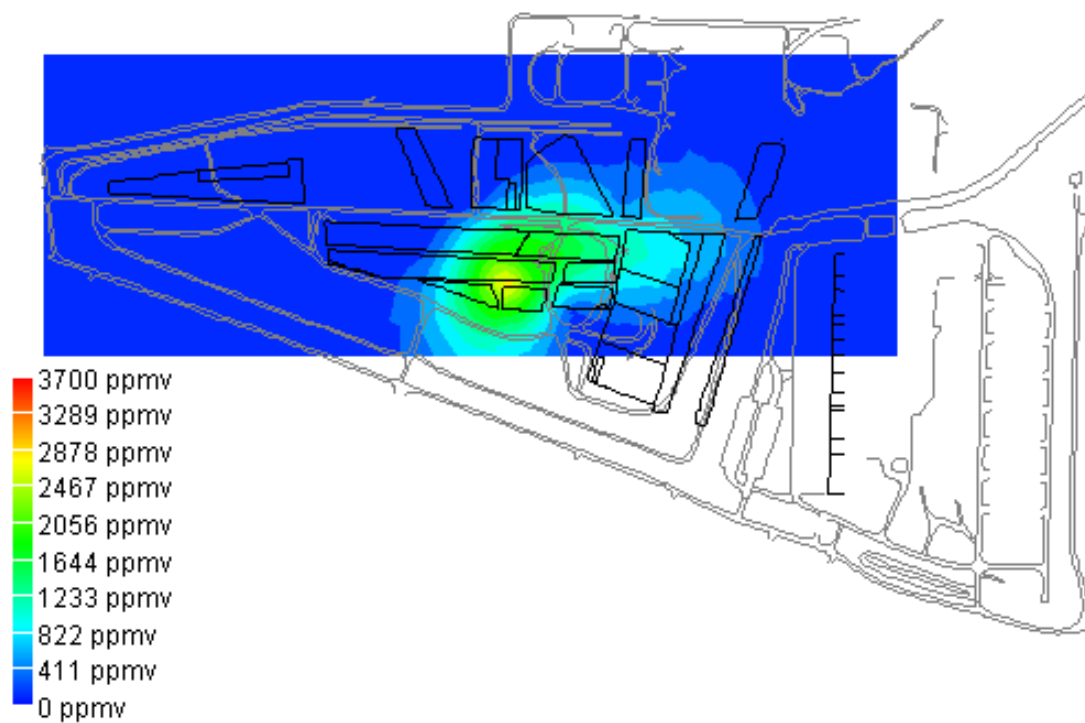


Figure 10-11. Spatial distribution of CCl_4 in the SDA at approximately 70 ft bls in March 2004 (ICP 2004b).

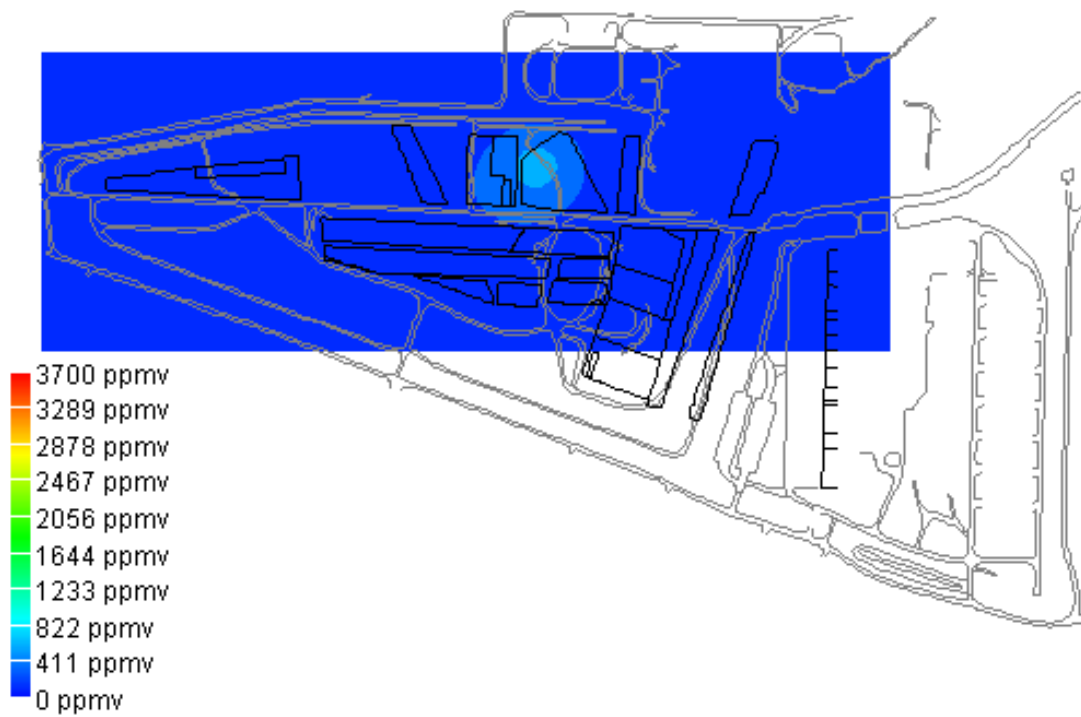


Figure 10-12. Spatial distribution of CCl_4 in the SDA at approximately 70 ft bls in July 2004 (ICP 2004b).

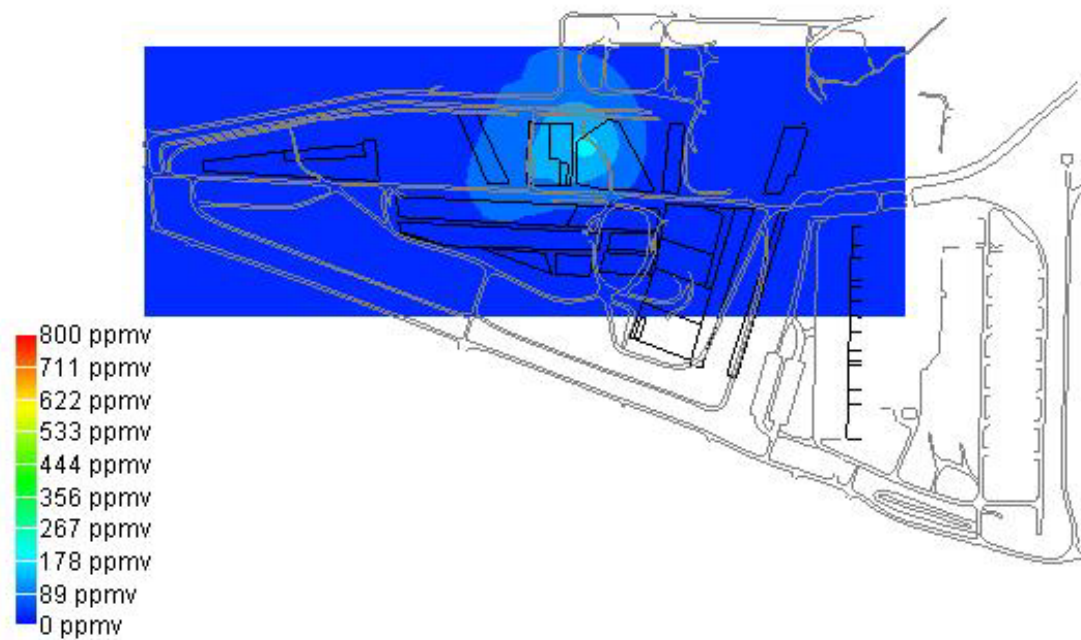


Figure 10-13. Spatial distribution of CCl_4 in the SDA at approximately 70 ft bls in September 2004 (ICP 2004b).

10.1.4 Technical Assessment

Question A: *Is the remedy functioning as intended by the decision documents?*

Based on monitoring results, concentrations of contaminants are decreasing in the vast majority of the vadose zone monitoring points, especially above the B-C interbed (i.e., 110 ft bls), where most of the extraction has occurred. Reductions in concentrations have been most steady in areas located away from source zones. Groundwater monitoring currently indicates two of 20 wells in the RWMC area (M7S and the RWMC production well) are above MCLs for CCl₄. Some of the wells continue to show a slightly increasing trend in CCl₄ concentrations, while others indicate a flat or decreasing trend. The total extent of CCl₄ contamination in the SRPA downgradient of the RWMC is unknown. Although not remediated under the OU 7-08 ROD, groundwater will be further investigated in the OU 7-13/14 comprehensive ROD and is important in evaluating the effectiveness of OCVZ extraction and treatment. The impacts of OCVZ operations were not expected to be manifest in the groundwater for several years, but continued extraction under the OCVZ Project is anticipated to result in declining groundwater concentrations.

Institutional controls, such as controlled access and fencing, are in place and remain effective, based on periodic inspections and monitoring of the site.

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?*

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. There have been no changes in the RAOs found in the decision document and no new standards affecting the protectiveness of the remedy.

Question C: *Has any other information come to light that could call into question the protectiveness of the remedy?*

No.

10.1.5 Technical Assessment Summary

Issues that were discussed in the 2003 five-year review of OCVZ have been resolved favorably. The reliability of the OCVZ system has been greatly improved by replacing aging equipment. New extraction wells are in place to support the treatment units. Monitoring below the 240-ft interbed has been improved, as has the monitoring of exhaust gases. Based on monitoring results, concentrations of contaminants are decreasing in the vast majority of vadose zone monitoring points. Reductions in concentration have been most steady in areas located away from source zones. Additionally, the source of the organic contaminants is being removed under separate remedial actions—that is, plans call for most of the organics in Pit 4 to be removed. Removal of the source loading will have a positive impact on the conditions in the vadose zone below the SDA, as will the improved performance of the OCVZ treatment units.

Groundwater monitoring currently indicates that CCl₄ concentrations in two of the wells in the RWMC area are above MCLs. Several of the wells show an increase in CCl₄ concentrations, but the rate of increase is slowing. Several other wells show a flat or decreasing trend in CCl₄ concentrations. Groundwater will be further investigated in the OU 7-14 comprehensive ROD and is not remediated under the OU 7-08 ROD, but recognizing contaminant detections above MCLs is important. It is also important to note that impacts from OCVZ operations, especially the focus on shallow extraction, were

not anticipated to influence groundwater for several years. However, continued OCVZ operations are expected to result in a reduction of groundwater concentrations to less than MCLs.

10.1.6 Issues

There are no outstanding issues related to the OCVZ remedial activity. The operation of the OCVZ units and associated monitoring will continue for the foreseeable future.

10.1.7 Recommendations and Follow-up Actions

Recommendations are to continue OCVZ system operation and perform associated monitoring.

10.1.8 Protectiveness Statement

The OCVZ remedy is functioning as the OU 7-08 ROD intended (DOE-ID 1994a). Current monitoring data indicate that the remedy is functioning as required to achieve current cleanup goals. The long-term effectiveness of the remedy will be verified by monitoring of VOCs in the vadose zone and in groundwater within and outside of the SDA boundary. Monitoring will continue for the foreseeable future.

10.2 Operable Unit 7-10 (Pit 9)

Covering an area of about 1 acre, Pit 9 is one of 10 pits (and 58 trenches) in the SDA where TRU waste, mixed waste, and other radioactive waste from the Rocky Flats Plant and other waste generators were disposed of between November 1967 and June 1969. During that period, drums and boxes of waste were dumped into the pit using trucks or bulldozers, and cranes were used to place large items in the pit. The waste was then covered with soil after weekly or daily operations, depending on procedure requirements at the time of disposal.

Per the action plan attached to the FFA/CO (DOE-ID 1991), OU 7-10 consists of the Pit 9 process demonstration interim action. In 1993, the Pit 9 ROD was signed (DOE-ID 1993). The ROD specifies that OU 7-10 will be subject to a five-year review, with the effectiveness of the Pit 9 interim action as a final action to be evaluated in OU 7-13 (i.e., the TRU-contaminated pits and trenches remedial investigation/feasibility study [RI/FS]).^a An associated remedial design/remedial action (RD/RA) scope of work and work plan (EG&G 1993) documented the schedule and approach for implementation of the ROD; the U.S. Department of Energy (DOE) management and operating contractor subcontracted with Lockheed Martin Advanced Environmental Systems (LMAES) to perform the Pit 9 scope of work.

The Pit 9 scope of work was modified in Revision 1 of the associated RD/RA scope of work and work plan (LMITCO 1995) to address details for design, construction, and operation approaches. This resulted in significant changes in cost estimates for the Pit 9 ROD, which in turn required issuance of a 1995 explanation of significant differences (ESD) to the Pit 9 ROD (DOE-ID 1995).

LMAES designed and then began construction of a retrieval facility and TRU waste processing building. However, in response to missed milestones by LMAES, the DOE Idaho Operations Office (DOE Idaho) prepared a contingency plan to address the possibility that LMAES might not fulfill the terms of the Pit 9 scope of work (EG&G 1993). That contingency plan developed into the staged interim

a. The OU 7-13 TRU pits and trenches RI/FS was subsequently combined with the OU 7-14 WAG 7 comprehensive RI/FS into the OU 7 13/14 WAG 7 comprehensive RI/FS.

action approach formalized in Revision 2 of the RD/RA scope of work and work plan (INEL 1997). It identified performance objectives, milestones, and deliverables in the event that the LMAES contract was not completed. The LMAES contract was subsequently terminated, and work began on the OU 7-10 Staged Interim Action Project. The uncompleted LMAES retrieval and processing structures remain at the Pit 9 site and are planned for future decommissioning.

A 1998 ESD to the Pit 9 ROD formalized adoption of a three-stage approach to satisfy requirements of the ROD and officially launched the OU 7-10 Staged Interim Action Project (DOE-ID 1998). The three stages of the OU 7-10 Staged Interim Action Project are as follows (INEL 1997, Appendix A):

- **Stage I**—subsurface exploration of Pit 9 to support site selection for Stage II.
- **Stage II**—retrieval of a selected area of Pit 9, including a waste retrieval demonstration, characterization of waste zone material and soil, and storage of retrieved waste zone material. Stage II also included design and construction, waste examination and packaging, and facility disposition.
- **Stage III**—overall remediation of Pit 9 using information from Stage II.

The purpose of the Stage I subsurface exploration was to obtain data from a portion of Pit 9 to support Stage II site selection for the limited excavation and retrieval of buried TRU waste. To meet the objectives of Stage I, a 40- × 40-ft study area was selected based on a review of inventory records of the pit and the results of noninvasive radiological and geophysical surveys of the pit. Subsurface exploration of this area included installation of tipped steel casings to allow probing by downhole data-logging instruments and subsequent coring to obtain samples for analysis and bench-scale treatability studies. The subsurface geophysical and radiation-detection logging in the cased probe holes was completed. Stage I objectives were effectively met with the selection of the location for the Stage II demonstration retrieval area.^b

Requirements that applied to all three stages of the OU 7-10 Staged Interim Action Project were identified in the systems requirements document (LMITCO 1998), while the technical and functional requirements (TFRs) document (TFR-2527) defined the Stage II scope and activities. The TFRs document became the technical baseline used to develop the design for Stage II. The 90% design for Stage II was submitted to the agencies on June 15, 2000, as part of the *Remedial Design/Remedial Action Work Plan for Stage II of the Operable Unit 7-10 (OU 7-10) Staged Interim Action Project* (INEL 1997).

While the Stage II design met all technical requirements, the associated schedule did not meet the enforceable deadline for completion of the remedial action report. The DOE requested a schedule extension under the FFA/CO, but the request was denied by the agencies, resulting in a formal dispute in accordance with the provisions of the FFA/CO. As part of the dispute-resolution process, alternate concepts to demonstrate retrieval were developed. The alternate concepts focused on using simpler methods and shortening the overall duration of the retrieval demonstration. In some cases, the overall project objectives had to be modified from those of the original Stage II mission. The resulting concepts were documented in *Waste Area Group 7 Analysis of OU 7-10 Stage II Modifications* (INEEL 2001). The concept selected was the glovebox excavator method (Figure 10-14). Through an agreement to resolve disputes (ARD) (DOE-ID 2002a) the agencies formally adopted the glovebox excavator method for accomplishing the Stage II mission and established new enforceable milestones for implementation of the Pit 9 Process Demonstration, including the future commencement of operations for Stage III. The

b. *OU 7-10 Stage I Subsurface Exploration and Treatability Studies Report (Draft) - Initial Probing Campaign (December 1999–June 2000)*, INEEL/EXT-2000-00403, Idaho National Engineering and Environmental Laboratory, July 2000.

Remedial Design Package for the OU 7-10 Glovebox Excavator Method Project (DOE-ID 2002b) was submitted to the agencies on October 1, 2002, and finally established the design requirements for implementing and completing Stage II through the glovebox excavator method. The agencies agreed to extend the Remedial Design and Commence Stage III Construction milestone to March 31, 2008, in an agreement to extend deadlines (DOE-ID 2004a).

Table 10-4 provides a chronology of significant events at OU 7-10.

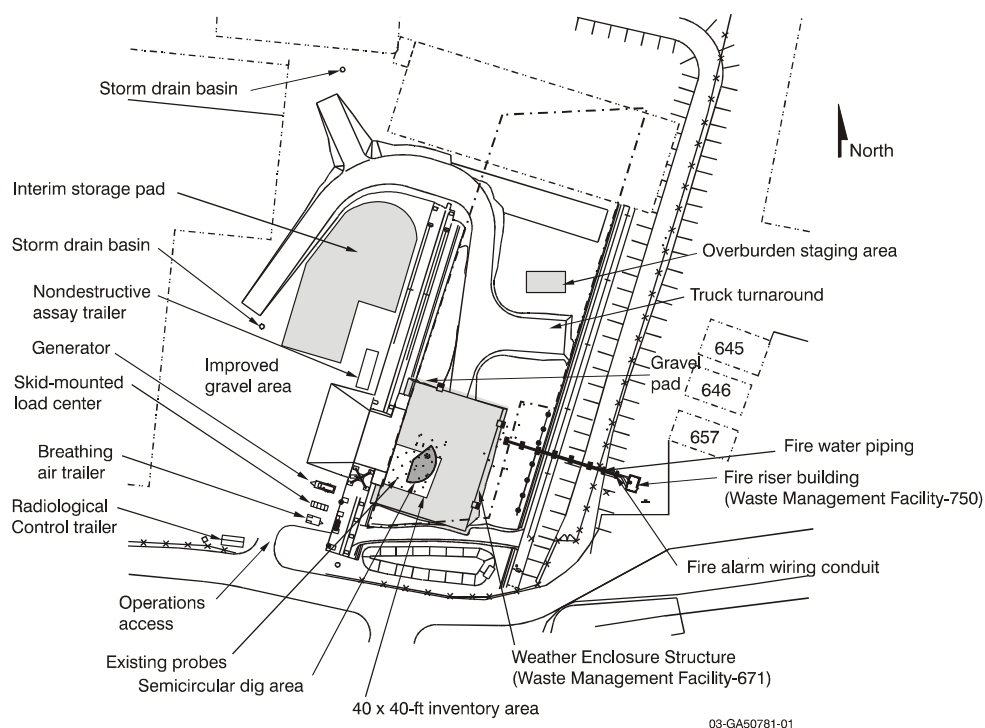


Figure 10-14. Site plan of the OU 7-10 the Glovebox Excavator Method Project.

Table 10-4. Chronology of OU 7-10 events.

Event	Date
The RWMC was established.	1950
Rocky Flats Plant and INL Site waste materials were disposed of in Pit 9.	November 1967–June 1969
The <i>Pit 9 Interim Action ROD</i> (DOE-ID 1993) was signed by the agencies.	October 1993
The 1995 ESD (DOE-ID 1995) was issued.	January 1995
The <i>Revised Pit 9 Scope of Work</i> (INEL 1997) was issued. The revision included a contingency for a staged interim action approach if the LMAES contract was not completed.	October 1997
The LMAES subcontract for Pit 9 remediation was terminated.	June 1998
The 1998 ESD (DOE-ID 1998) was issued. The ESD adopted the three-stage approach to implement the Pit 9 interim action ROD.	September 1998
The <i>OU 7-10 Staged Interim Action Project System Requirement Document</i> (LMITCO 1998) was issued.	October 1998

Table 10-4. (continued).

Event	Date
The OU 7-10 interim action project, Stage II RD/RA work plan ^a was submitted to the agencies.	June 2000
The <i>OU 7-10 Stage I Subsurface Exploration and Treatability Studies Report (Draft)</i> ^b was completed.	July 2000
The <i>Waste Area Group 7 Analysis of OU 7-10 Stage II Modifications</i> (INEEL 2001) was completed. The analysis recommends adopting the glovebox excavator method as an improved approach for a Stage II retrieval demonstration.	October 2001
The ARD (DOE-ID 2002a) was signed by the agencies. The ARD formally adopts the glovebox excavator method as the approach to complete Stage II.	April 2002
The <i>Remedial Design Package for the OU 7-10 Glovebox Excavator Method Project</i> (DOE-ID 2002b) and the <i>Remedial Design Supplemental Package for the OU 7-10 Glovebox Excavator Method Project</i> (DOE-ID 2002c) were submitted.	October 2002
The construction and installation of process equipment were completed on the Glovebox Excavator Method Project facility.	May 2003
The agency pre-final inspection for the glovebox excavator method was completed.	November 2003
Retrieval of buried waste in Pit 9 was initiated.	January 2004
The Stage II/glovebox excavator method waste retrieval demonstration operations were completed. The design volume of 75 yd ³ of buried waste was retrieved.	February 2004
The agency final inspection for the glovebox excavator method was completed.	May 2004
The agreement to extend deadlines was signed by the U.S. Environmental Protection Agency, Idaho Department of Environmental Quality, and DOE to memorialize that the Accelerated Retrieval Project met the Stage III 10% design milestone and to extend the completion date of the Remedial Design and Commence Stage III Construction milestone until March 31, 2008 (DOE-ID 2004a).	June 2004
The <i>Remedial Action Report for the OU 7-10 Glovebox Excavator Method Project</i> (DOE-ID 2004b) was completed.	November 2004
The <i>Action Memorandum for the Accelerated Retrieval of a Described Area within Pit 4</i> (DOE-ID 2004c) was signed. Implementation of the Accelerated Retrieval Project non-time critical removal action in Pit 4 will meet the 10% design milestone for Stage III activities in Pit 9.	August 2004
Construction of the Accelerated Retrieval Project facility at Pit 4 was completed.	September 2004
<p>a. <i>Binder A-I Remedial Design/Remedial Action Work Plan for Stage II of the Operable Unit 7-10 (OU 7-10) Staged Interim Action Project</i>, DOE-ID-10767, Rev. Draft, U.S. Department of Energy Idaho Operations Office, June 2000.</p> <p>b. <i>OU 7-10 Stage I Subsurface Exploration and Treatability Studies Report (Draft) - Initial Probing Campaign (December 1999–June 2000)</i>, INEEL/EXT-2000-00403, Idaho National Engineering and Environmental Laboratory, July 2000.</p>	

10.2.1 Remedy Selection

Remedial action operations and maintenance activities for implementing Stage II of the OU 7-10 interim action included overburden removal, waste retrieval, underburden sampling, waste-drum storage, data collection and analysis, maintenance, and facility monitoring.

Overburden removal began on December 12, 2003. Waste zone retrieval operations began on January 5, 2004. On February 24, 2004, DOE Idaho notified the Idaho Department of Environmental Quality (DEQ) and the U.S. Environmental Protection Agency (EPA) of the completion of waste retrieval for the project.

During the retrieval effort, excavator operators took scoops of waste zone materials (see Figure 10-15) and placed them in transfer carts at one of three gloveboxes. Glovebox operators moved the transfer carts into the gloveboxes, segregated the waste zone material (see Figure 10-16), separated and measured suspect fissile material, and packaged the waste in appropriate storage containers (i.e., 55-gal drums) in a safe and compliant manner. When operators suspected fissile material in the waste, the suspect material was placed in a separate bucket and moved to a fissile material monitor for measurement and subsequent placement in an appropriate drum, ensuring that criticality limits were never exceeded. Once the drums were filled, operators changed out drums and transferred them for assay measurement and then to interim storage in Building WMF-628, Type II Storage Module #1. Composite samples were analyzed to support application of hazardous waste numbers. Each drum identification number was entered into the Integrated Waste Tracking System.

A total of 454 drums were filled during the retrieval effort, most containing approximately 5 ft³ of waste materials, thus meeting a project objective of removing more than 75 yd³ of material. Waste drums found in the pit had little structural integrity due to corrosion. However, plastic bags and plastic containers had retained much of their integrity. Some bags were more brittle than others, but most were in extremely good condition. It was noted that writing and markings on plastic containers and labels protected by plastic were often still clear and legible. Operators removed six underburden cores from the interface of the waste zone and underburden. Cores contained in Lexan tubes were removed from the core barrel, bagged out of the retrieval confinement structure, and shipped to a laboratory at the Idaho Nuclear Technology and Engineering Center for analysis.

The milestone for completion of the Pit 9 Stage III 10% design by September 2005 is being met through the ongoing removal action in Pit 4 of the SDA. In August 2004, the agencies signed an action memorandum to conduct a non-time-critical removal action for limited excavation and retrieval of selected waste streams from a 1/2-acre plot in the eastern portion of Pit 4. The waste in this area is primarily from the Rocky Flats Plant. The area was selected by the DOE, the Idaho DEQ, and the EPA based on inventory evaluations identifying significant quantities of TRU and other contaminated waste disposed of in the area. The project is referred to as the Accelerated Retrieval Project.

The focused objective of the non-time-critical removal action is to perform a targeted retrieval of certain Rocky Flats Plant waste streams that are highly contaminated with TRU radionuclides, VOCs, and various isotopes of uranium. Performance of the action will accomplish the following:

- Remove targeted waste streams and associated contaminants from a portion of the SDA.
- Reduce the overall TRU, VOC, and uranium inventory buried within the SDA.
- Establish the administrative process for certifying and transferring the resulting retrieved TRU waste streams to the Waste Isolation Pilot Plant in New Mexico.
- Provide information to support remedial work at the RWMC as defined by future Comprehensive Environmental Response, Compensation, and Liability Act removal action documentation or the OU 7-13/14 ROD.

The agencies are also proposing a second phase non-time-critical removal action in the remaining portions of Pit 4. The agreement to extend deadlines (DOE-ID 2004a) provides an enforceable milestone to complete the remedial design for Stage III and commence construction no later than March 31, 2008, and to begin operations within the following 36 months. The enforceable deadline for submittal of a draft OU 7-13/14 ROD is December 31, 2007.



Figure 10-15. The glovebox excavator retrieving waste from Pit 9.



Figure 10-16. Glovebox excavator operators segregating waste retrieved from Pit 9.

10.2.2 Data Evaluation

Data collected during Glovebox Excavator Method Project are presented in the *Remedial Action Report for the OU 7-10 Glovebox Excavator Method Project* (DOE-ID 2004b). A brief summary of environmental and waste management-related data is included in the following subsections. The data primarily include analyses of stack air emissions, radiological assay and solids sampling of retrieved wastes, and sampling of underburden soils. This information will support the design efforts for future waste retrieval operations in the SDA and has been factored into the design planning for the Accelerated Retrieval Project. The data obtained from completion of Stage II provide information relevant to predicting impacts from future retrieval operations as they pertain to occupational exposures, waste classifications for disposition, and air emissions estimates.

Biased and composite sampling of waste zone material (i.e., soil and waste solids) was performed in the designated excavation area of Pit 9. The composite waste zone sampling process required the collection of small incremental subsamples from each cart used to fill each drum in a five-drum campaign. Subsamples from all carts used to fill five drums were composited into one sample representing the five-drum campaign. The sampling strategy was designed to provide a very accurate estimate of the population mean, because every drum contributes to the estimate by contributing to a five-drum composite.

Sample analysis results provided the basis for determining the upper 90% confidence limit (UCL_{90}) of the mean concentration of the contaminants listed in the DQOs. As stated in Section 2.1.4 of the *Field Sampling Plan for the OU 7-10 Glovebox Excavator Project* (Salomon et al., 2003), the boundary of this characterization was the physical contents of the newly packaged drum population being characterized. Material type was limited to nondebris waste because, for the analyses required by the field sampling plan (FSP), debris waste would be better characterized using acceptable knowledge and nondestructive analysis. The results from laboratory analyses of the composited waste samples are appropriately applied to only the population of nondebris, soil, and waste-solids drums.

A statistical analysis of the composite sample data was performed. The purpose of the statistical analysis of the data collected is to calculate the UCL_{90} for the population means and compare that to regulatory thresholds to determine whether hazardous waste codes should be assigned.

The interpretation of the UCL_{90} is that the project can be 90% confident that the true population mean is less than the UCL_{90} value computed from the sample mean and standard deviation. If the UCL_{90} value is less than the regulatory threshold, then the project has demonstrated with at least 90% confidence that the true population mean is less than the regulatory threshold.

The project collected 82 composite samples from the waste zone. The mean concentration, standard deviation, and UCL_{90} for each contaminant are presented below by analysis type.

10.2.2.1 Polychlorinated Biphenyls. The total polychlorinated biphenyl (PCB) result of 37 mg/kg is a sum of the UCL_{90} results for the PCB congeners. The result is below the Toxic Substances and Control Act regulatory limit of 50 mg/kg. Total PCBs are identified as an underlying hazardous constituent (UHC) for the soil and waste solids drum population, because the total is greater than 10 mg/kg.

10.2.2.2 Semivolatile Organic Compounds. No hazardous waste codes or UHC codes are applied to the soil and waste solids drum population based on results of the semivolatile organic compound analysis.

10.2.2.3 Volatile Organic Compounds. Hazardous Waste Codes D028, D018, D019, D039, D040, and D043 are applied to the soil and waste solids drum population based on the 1,2-dichloroethane, benzene, CCl₄, PCE, TCE, and vinyl chloride analysis results, respectively. The 1,1,1-TCA, 1,1,2,2-PCE, 1,1,2-TCA, 1,1-dichloroethene, carbon disulfide, chlorobenzene, ethylbenzene, methanol, and toluene are identified as UHCs for the soil and waste solids drum population.

10.2.2.4 Metals. Cadmium, chromium, lead, vanadium, and zinc are identified as UHCs for the soil and waste solids drum population.

10.2.2.5 Nitrate. Analysis for nitrate was performed for each soil and waste solids composite sample. No hazardous waste codes or UHCs were identified for the soil and waste solids drum population.

10.2.2.6 Biased Samples. The project included biased sampling to identify potential drum subpopulations that could pose a safety risk or regulatory issue to the project. Included in this category were drums suspected of containing nitrate-bearing waste (because of their ignitable potential that affects both safety and regulatory issues), uncontainerized liquids potentially containing liquid PCBs, cyanide pellets or other special-case waste, outlier waste, and other unplanned sampling opportunities. During waste examination and packaging operations, a total of four samples were collected from material that might contain nitrate-bearing waste. No uncontainerized liquids, cyanide pellets, or other special-case waste were identified for sampling during excavation. No hazardous waste codes were applied to the at-risk drums based on the biased samples collected.

The biased nitrate sample represents (proportionally) both suspect and nonsuspect material. Nonsuspect material (e.g., soil and other waste) would contribute to the sample in the approximate proportion that they exist compared to the suspect nitrate-bearing material in the cart. Therefore, while the results of the biased sampling are useful to support identification of at-risk (i.e., nitrate) drums, the reported concentrations are only representative of the cart and do not represent the contaminant concentrations of the nitrate-bearing waste or the final concentration of a particular drum.

Biased samples of sludge and biased samples of interstitial soil were collected to support ongoing OU 7-13/14 studies. Results will be presented in final reports for the retrieved waste and soils characterization and the pre-remedial design testing studies.

10.2.2.7 Volatile Organic Compound Monitoring. Photoionization detector readings were taken from the exhaust duct after the high-efficiency particulate air (HEPA) filters. Readings were taken on an intermittent basis from May 28, 2003, to February 25, 2004 (DOE-ID 2004b).

SUMMA sampling was performed at various times from the exhaust duct after the HEPA filters (McIlwain 2004). These samples were sent to an off-site laboratory for analysis. Results of these readings are presented in Figure 10-17 with a comparison to anticipated VOC levels, as documented in EDF-2376, “Estimates of Carbon Tetrachloride Air Concentrations within the OU 7-10 Retrieval Confinement Structure and Packaging Glovebox System during Various Phases of Stage II Retrieval Activities,” and with photo ionization detector readings. The results of the SUMMA grab sample analysis include total measured VOCs and measured CCl₄. Measured VOCs were approximately half the anticipated levels over the measurement period.

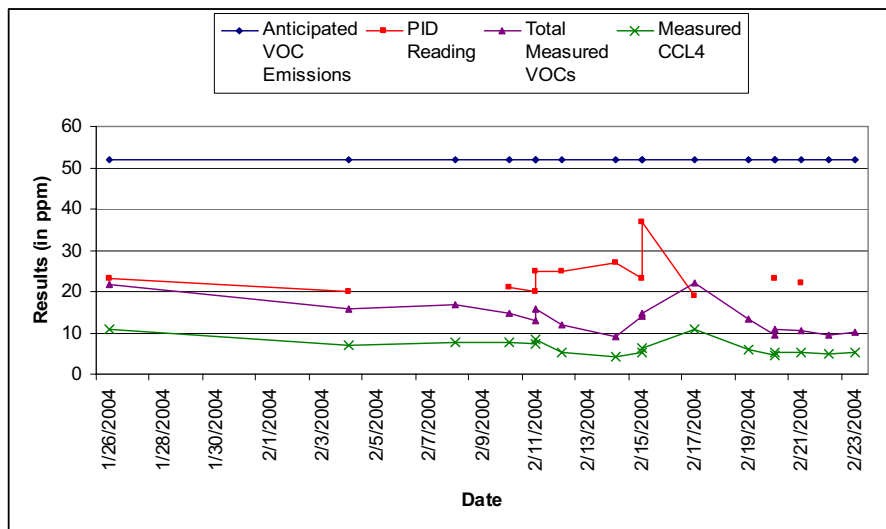


Figure 10-17. Comparison of anticipated VOC levels with photoionization detector readings and SUMMA canister grab sample analytical results.

10.2.2.8 Radiological Assay. Four hundred fifty-four drums were assayed. Most of them had only a small amount of TRU activity present, primarily from Am-241. Each of the isotopes Pu-238, Pu-239, Pu-240, Pu-241, U-235, U-238, Am-241, Np-237, Na-22, and Cs-137 was detected at least once. The dominant isotopes were Am-241 and Pu-239. The Pu-239 fissile gram equivalent values calculated for the assayed drums were all below 100 g, except for one drum, GEM030438, which calculated to 363 g with the inclusion of the 1-sigma error. Isotopic measurements showed isotopic distribution consistent with weapons-grade plutonium distributions. Sixty drums were found to be TRU waste, based on the assay value for total concentrations. If the 1-sigma error was included, the number of TRU waste drums increases to 193.

10.2.2.9 Underburden Sampling. The core sampling performed was intended to characterize contaminants of interest in the underburden and to support subsequent evaluations of the potential for contaminant migration. Five locations were sampled, and a duplicate core was obtained for one of the locations. Results of the analyses are presented in the remedial action report (DOE-ID 2004b).

Results in the remedial action report confirm that the presumed underburden contains high levels of TRU contaminants, with two subsamples exhibiting Pu-239 concentrations greater than 100 nCi/g. Preliminary evaluation of the relative abundance of TRU elements within these subsamples suggests that this contamination most likely resulted from mixing of waste and underburden soil during waste retrieval. Variations in the relative abundance of Pu-239 and Am-241 from subsamples are suggestive of chemical transport processes.

10.2.3 Progress since Last Review

This is the first review of the remedy for OU 7-10. Periodic modifications to the remedy originally described in the 1993 OU 7-10 ROD (DOE-ID 1993) have occurred more often than five-year intervals, precluding the need to perform a review before now.

10.2.4 Technical Assessment

Question A: *Is the remedy functioning as intended by the decision documents?*

The waste retrieval and processing demonstration from the Glovebox Excavator Method Project, as well as activities now under way for the Accelerated Retrieval Project, have shown that TRU waste removal at the SDA is technically viable. Stage III operations for Pit 9 are still in the design phase.

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?*

The OU 7-10 response action was undertaken as an interim action and a demonstration project. It is anticipated that the final cleanup levels and RAOs will be established either through the Stage III remedial design approval process or through issuance of a future ROD or ROD modification. The final exposure assumptions, toxicity data, cleanup levels, and RAOs for the SDA will be established through the issuance of the OU 7-13/14 ROD.

Question C: *Has any other information come to light that could call into question the protectiveness of the remedy?*

No.

10.2.5 Technical Assessment Summary

The remedy for OU 7-10 is a buried waste retrieval demonstration that is composed of three principal components. Stage I provided for further investigation of Pit 9 to identify a suitable location to conduct Stage II operations. Stage II provided for limited retrieval of a portion of Pit 9 and collection of data to support future waste retrieval operations at the SDA. Stage III will provide for waste retrieval operations over the remainder of Pit 9. Stage I and II operations have been completed and have successfully demonstrated that retrieval of buried wastes at the SDA is technically viable. Remedial design activities for Stage III are under way and are being supported by the Accelerated Retrieval Project removal action in Pit 4.

10.2.6 Issues

Two open questions have been identified during this five-year review of the remedy for OU 7-10. First, the amount of retrieved waste that will require treatment to meet the waste acceptance criteria for the Waste Isolation Pilot Plant is unknown. This uncertainty complicates the ability to develop reliable cost estimates for Stage III operations and to determine compliance approaches for applicable or relevant and appropriate requirements (ARARs). Second, the RAOs, the ARARs, and the treatment train identified in the OU 7-10 ROD need to be updated. The original ROD was signed 11 years ago, and several developments since then create a need to update the requirements. These developments include the 1995 and 1998 ESDs (DOE-ID 1995, 1998), the 2002 ARD (DOE-ID 2002a), and the 2004 agreement to extend deadlines (DOE-ID 2004a).

10.2.7 Recommendations and Follow-up Activities

The Accelerated Retrieval Project removal action is fulfilling requirements in the ARD (DOE-ID 2002a) for a 10% Stage III remedial design by September 2005. Estimates of the amount of retrieved waste that will need to be treated will be obtained from experience gained through the removal

actions. Assumptions about waste treatment volumes from the Accelerated Retrieval Project can be included in the 90% Stage III remedial design.

Significant changes in OU 7-10 ROD implementation have occurred since the LMAES subcontract was terminated, so the RAOs, ARARs, treatment train, and enforceable schedules identified in the ROD have been modified through several subsequent documents. These requirements should be updated and consolidated in a single reference through either the Stage III remedial design process or a future ROD modification.

10.2.8 Protectiveness Statement

Upon completion, the OU 7-10 remedy is expected to be protective of human health and the environment. In the interim, exposure pathways that could result in unacceptable risk are being controlled. The OU 7-10 remedy is being implemented as a demonstration project and is not intended to be the final remedy for the SDA.

The milestone for completion of the Pit 9 Stage III 10% design is being met through the ongoing removal action in Pit 4 (i.e., the Accelerated Retrieval Project). The ARD (DOE-ID 2002a) establishes the milestone for commencement of operations for Stage III of the OU 7-10 demonstration project no later than March 31, 2010. The 2004 agreement to extend deadlines extends the deadline for remedial design and commencing construction until March 31, 2008 (DOE-ID 2004b). The final remedy for the SDA will be determined by the OU 7-13/14 ROD. The draft OU 7-13/14 ROD is scheduled for submittal to the Idaho DEQ and EPA no later than December 31, 2007.

10.3 Operable Unit 7-12 (Pad A)

Pad A is an aboveground, earthen-covered disposal site at the SDA where approximately 13,300 yd³ of containerized waste was placed from September 1972 to August 1978. The waste is composed primarily of nitrate salts, depleted uranium waste, and sewer sludge. Typically, the waste exhibited dose rates of less than 200 mR/hr at the surface of each container.

In 1978, Pad A was closed by placing plywood and/or polyethylene over the exposed containers. The waste pile was then covered by a layer of soil with an average thickness of 4 ft, and crested wheat grass was planted in the soil layer. Remediation of Pad A is addressed under OU 7-12 and was accomplished in accordance with the Pad A ROD (DOE-ID 1994b).

A risk assessment of Pad A indicated that it posed no current risk to workers or the public. Fate and transport modeling indicated that drinking water standards for nitrates might be exceeded in about 250 years if residents use the groundwater directly adjacent to the Pad A boundary, but the modeling used conservative assumptions in order not to underestimate risks. Actual nitrate concentrations in groundwater were not expected to exceed drinking water standards at the WAG 7 boundary, so Pad A was not expected to pose an unacceptable risk to human health or the environment (DOE-ID 1994b).

In 1997, the EPA completed the *Two-Year Review Idaho National Engineering Laboratory Subsurface Disposal Area Pad A Operable Unit 7-12* (EPA 1997), which was reviewed by the DEQ. The DEQ certified that the limited action remedy for Pad A was protective of human health and the environment. Subsidence of the soil cover, the frequency of inspections, and the inability to establish adequate grass cover were issues, however.

A two-phase limited action was completed in 1995 to prevent contact with wastes disposed of at Pad A. Phase I consisted of recontouring the sides of the pad to establish appropriate slopes and grading

the top of the pad to achieve a minimum 5% slope. Phase II consisted of installation of suction lysimeters and neutron access tubes to provide early detection of potential contaminant releases to the environment. Results of this limited action are presented in the *Remedial Action Report Pad A Limited Action Operable Unit 7-12* (Parsons Engineering Science 1995a).

In 2003, the *Five-Year Review Report for OU 7-12 (Pad A) Idaho National Engineering and Environmental Laboratory* (EPA 2003) was completed by the EPA and reviewed by the DEQ. The EPA determined that the remedy prescribed for Pad A was protective of human health and the environment. The data indicated that the cover was protective, ongoing maintenance and institutional controls precluded prolonged direct contact with Pad A contaminants, and the remedy was functioning as required. However, continued monitoring was recommended. The continued lack of vegetation in some areas was also a concern.

The SDA, including Pad A, is being evaluated in the WAG 7 comprehensive RI/FS. Future decisions about OU 7-13/14 could affect elements of Pad A long-term stewardship. Table 10-5 provides a chronology of significant events at OU 7-12.

Table 10-5. Chronology of significant OU 7-12 events.

Event	Date
Pad A was constructed and used to dispose of wastes.	1972–1978
Environmental monitoring and investigations were conducted.	1978–1989
The INL Site received its final listing on the National Priorities List (54 FR 29820).	November 21, 1991
The FFA/CO (DOE-ID 1991) for the INL Site was signed.	December 9, 1991
Public scoping meetings for Pad A were held.	December 1991
The Pad A RI/FS was made available to the public.	January 1992
The Pad A proposed plan identifying the preferred remedy was presented to public, and the public comment period began (INEL 1993).	July 1993
The ROD selecting the limited action remedy was signed (DOE-ID 1994b).	January 27, 1994
The short-term monitoring plan was approved (Parsons Science Engineering 1995a, Appendix A).	June 1994
The Pad A limited action was completed.	May 1995
The remedial action report for the Pad A limited action was completed (Parsons Engineering Science 1995a).	July 1995
The long-term monitoring plan was approved (Parsons Engineering Science 1995b).	August 1995
The two-year review was completed.	December 17, 1997
The operations, maintenance, and monitoring plan was revised (Parsons Engineering Science 1995a, Appendix N).	January 2001
The five-year review was completed.	September 2003
Post-ROD monitoring is conducted.	1994–2005
The operations, maintenance, and monitoring plan was revised (Flynn 2005).	June 2005

10.3.1 Remedial Actions

10.3.1.1 Remedy Selection. In 1994, a ROD was signed for OU 7-12 (DOE-ID 1994b). Later in 1994, a limited action RD/RA work plan was signed (INEL 1994). The limited action described in the ROD prescribed that the waste be left in place and included recontouring and slope correction, cover maintenance and monitoring, and institutional controls. Pad A was intended to be a permanent solution where the wastes could be reliably controlled in place. Treatment of the principal sources of contamination was not found to be necessary.

Because the remedy resulted in wastes remaining onsite, continued maintenance and monitoring of Pad A were required. Maintenance was to include subsidence and erosion control of the Pad A cover. Monitoring was also prescribed to ensure the effectiveness of the existing cover. Groundwater, air, surface water, and soil monitoring were designed to provide early detection of a potential release to the subsurface, groundwater, or surface pathways and ensure that the cover remains effective.

Institutional controls were also to continue in order to protect human health and the environment.

10.3.1.2 Remedial Action Objectives. The focus of the RAOs was to maintain the effectiveness of the soil and grass cover on Pad A in order to prevent direct exposure to the waste and to minimize the potential for contamination to migrate from the waste. Since the last review, however, it was noted that revegetation efforts have not improved the vegetative cover in certain portions of Pad A, but no significant erosion has occurred in these areas. Therefore, the revegetation efforts have been suspended, as agreed upon by the agencies.

The RAOs also included the identification of preliminary remediation goals that are established based on risk and frequently used standards or applicable ARARs. The selected remedy for Pad A satisfies the criterion of overall protection of human health and the environment by minimizing the risk of potential contaminant migration to groundwater and by preventing direct contact with the Pad A waste materials. No chemical-specific ARARs are identified for the Pad A selected remedy.

10.3.1.3 Remedy Implementation. The Pad A remedy was implemented in two phases. The first phase consisted of recontouring the Pad A slopes, which was done between August and November 1995.

The second phase consisted of installing environmental monitoring equipment. This involved drilling boreholes, which were completed between April and July 1995. The RD/RA work plan (INEL 1994) specified that the EPA and Idaho DEQ would perform independent reviews of the maintenance and monitoring data within two years to ensure that the remedy continued to provide adequate protection of human health and the environment. The pre-final inspection for the first-phase recontouring activities was done on December 9, 1994. Outstanding items from the pre-final inspection were resolved and documented in the RD/RA report (INEL 1994). The EPA and DEQ determined that all remedial action construction activities, including institutional controls implementation and monitoring, were performed according to specifications.

The ongoing phase of remedy implementation at Pad A consists of long-term monitoring and maintenance. The operations and maintenance plan (Flynn 2005) has been revised. The primary activities associated with operations and maintenance include the following:

- Inspection and corrective maintenance of the soil cover
- Inspection and corrective maintenance of the rock armoring
- Monitoring of aquifer wells
- Monitoring of the vegetative cover, soil cover, and rock armor
- Inspection of institutional controls.

10.3.2 Data Evaluation

Seventy lysimeters and perched water wells at WAG 7 are sampled annually and analyzed for radionuclides, nitrate, metals, and VOCs (sample volume permitting). The locations of the lysimeters, perched water wells, and the contaminants detected there are shown in Figure 10-18.

At Pad A, lysimeter vadose zone wells PA01, PA02, PA03, D06, and TW-1 have been sampled annually.^c In addition, the USGS-092 perched water well is monitored for nitrate concentrations, which continue to increase. Figure 10-19 shows the trend for nitrates in Pad A lysimeters (including I4S:DL11) and in USGS-092. Elevated nitrate concentrations are observed in the vicinity of Pad A to depths around 100 ft bls (TW1 and I-4S). The drinking water MCL for nitrate is shown in Figure 10-18 for comparison only.

In addition, monthly operations and maintenance reports since the last review in 2003 indicate occasional small animal intrusions, minor weed growth, and minor subsidence events. One substantial subsidence event was noted on April 5, 2004, on the northeast side of Pad A. The subsidence was approximately three-quarters of the way to the top of the pad and was approximately 3 ft long, 1 ft wide, and 1 ft deep. The subsidence was repaired in accordance with the requirement in the ROD. Pad A still has no growth on the top and the north-northeast side.

Institutional controls at Pad A are monitored as part of the monthly operations and maintenance inspections and annually as part of the sitewide institutional controls inspection. Institutional controls at Pad A are in place and functioning as intended. Additionally, institutional controls are in place and functioning at the SDA, which surrounds the Pad A site.

Since the five-year review in 2003, the annual Pad A inspection report consisted of compiling all of the monthly inspections and submitting them along with a topographical map generated from the fiscal year 2004 survey for agency review. No significant issues have been identified regarding the cap.

10.3.3 Progress since Last Review

In 2003, the *Five-Year Review Report for OU 7-12 (Pad A) Idaho National Engineering and Environmental Laboratory* (EPA 2003) was completed by the EPA and reviewed by the Idaho DEQ. The EPA determined that the remedy at Pad A was protective of human health and the environment. The data indicated that the cover was protective, ongoing maintenance and institutional controls preclude prolonged direct contact with the water, and the remedy is functioning as required to achieve cleanup goals. However, continued monitoring actions were recommended to ensure that concentrations of contaminants in groundwater continue to decrease as anticipated. The continued lack of vegetation in some areas was also an issue of concern as was the status of the operations and maintenance plan and the institutional controls plan.

Required operations and maintenance, inspection sampling, and monitoring have been performed, documented, and reported. Occasional subsidence has been reported and corrected. Since the last review, it was noted that revegetation efforts have not improved vegetative cover in certain portions of Pad A. However, no significant erosion has occurred in those areas. Therefore, the revegetation efforts have been suspended, as agreed upon by the agencies. The Pad A operations and maintenance plan (Flynn 2005) was revised to remove the requirement for annual revegetation.

c. The requirement to monitor preferentially for nitrates annually from the Pad A lysimeters has been eliminated from the revised Pad A operations and maintenance plan based on cumulative risk assessments for OU 7-13/14 (Flynn 2005).

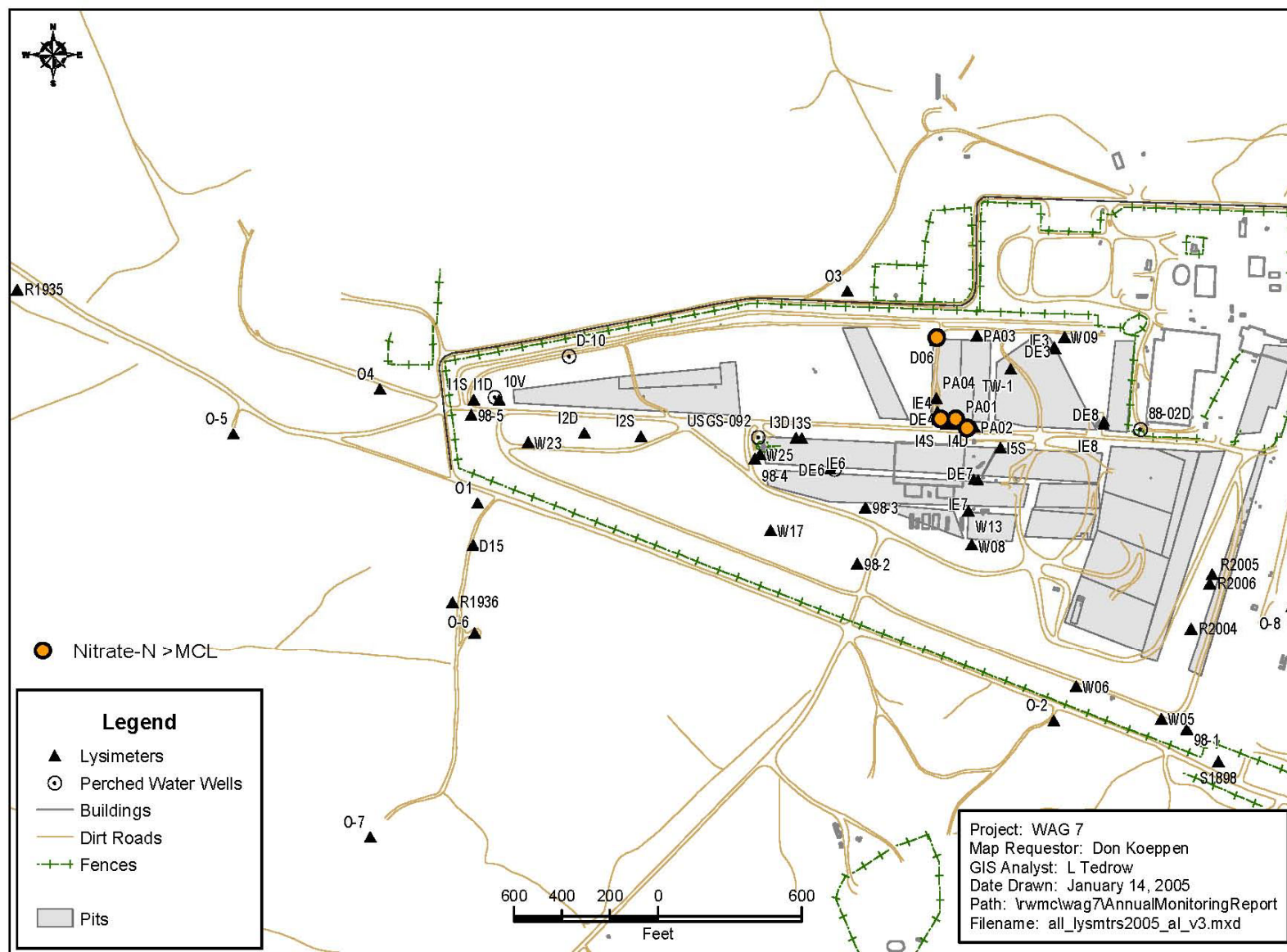


Figure 10-18. Lysimeters and monitoring wells at WAG 7.

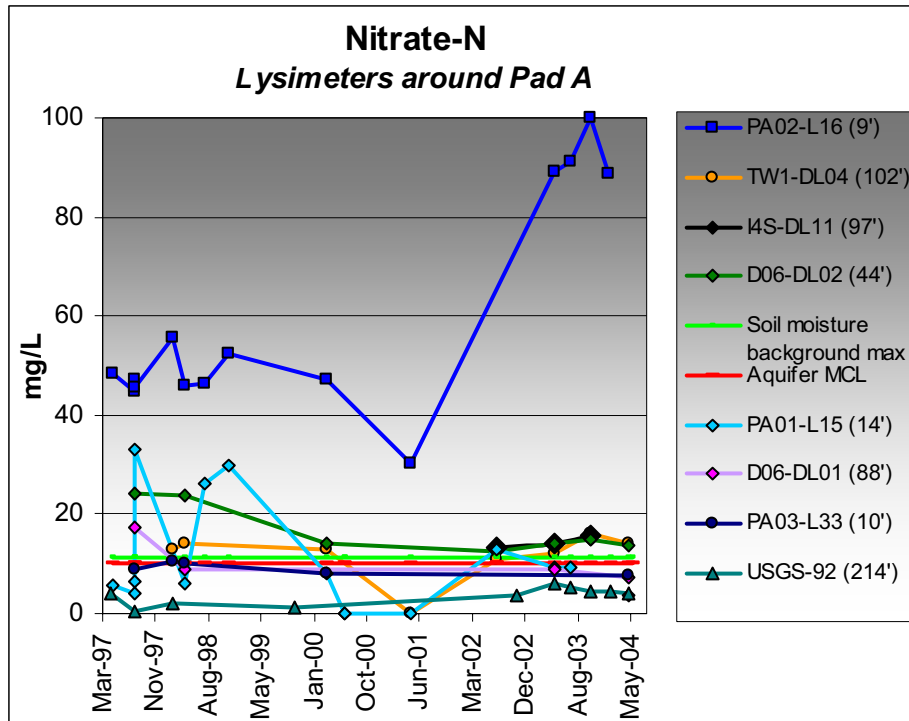


Figure 10-19. Nitrogen concentrations in lysimeters located around Pad A and in Well USGS-092.

The requirement for annual preferential monitoring of nitrates at the Pad A lysimeters has also been eliminated from the revised operations and maintenance plan, based on cumulative risk assessments for OU 7-13/14. The cumulative nitrate hazard index for the entire SDA using the upper-bound inventory for nitrates is 1 (Holden et al., 2002). The nitrate hazard index is based on best-estimate inventory and is less than the threshold value for remedial decision-making. Because Pad A nitrate sampling is conducted in conjunction with other WAG 7 sampling and the nitrate hazard index is 1, nitrates will be analyzed in lysimeter samples only when sufficient sample volume is available after other analytical priorities have been fulfilled. This change has been documented in the revised operations and maintenance plan (Flynn 2005).

10.3.4 Technical Assessment

Question A: *Is the remedy functioning as intended by the decision documents?*

The remedy is functioning as intended by the OU 7-12 ROD. The subsidence events have been minimal since the last review and have been repaired. Revegetation efforts have been discontinued on the portions of Pad A that have consistently failed to produce vegetative cover. Operations and maintenance costs are consistent with previous costs.

The lysimeter and monitoring well network is sufficient to provide data to assess potential releases from the pad. Maintenance on the cap is sufficient to maintain the integrity of the cap.

The required institutional controls are in place and functioning as intended. No activities were observed that would have violated institutional controls. The fence around the site is intact and in good repair.

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?*

Yes.

Question C: *Has any other information come to light that could call into question the protectiveness of the remedy?*

Lysimeter and well samples show nitrate concentrations at low levels with increasing trends. In addition, these constituents have been detected at lower depths since the last review. These trends, while they do raise questions as to the protectiveness of the Pad A remedy, are best viewed in the context of the SDA as a whole. Pad A is being evaluated in the OU 7-13/14 comprehensive RI/FS for WAG 7.

10.3.5 Technical Assessment Summary

Results from the monitoring at WAG 7 indicate that some contaminants are migrating from the waste zone. Nitrates are routinely detected around Pad A and should continue to be evaluated cumulatively under OU 7-13/14. Concentration trends associated with nitrates around Pad A are significant (Keppen et al. 2005).

The SDA, including Pad A, is being evaluated in the WAG 7 comprehensive RI/FS. Future decisions for OU 7-13/14 could affect elements of Pad A long-term stewardship.

10.3.6 Issues

Issues at Pad A include the continued detection of nitrates in the vadose zone. The significance of the detections is being evaluated in the context of the entire SDA in the OU 7-13/14 RI/FS.

10.3.7 Recommendations and Follow-up Actions

Operations, maintenance, and inspections should be continued at Pad A. Vadose zone monitoring should continue under OU 7-13/14 in accordance with priorities based on WAG-wide concerns. Semiannual aquifer monitoring should also continue.

10.3.8 Protectiveness Statement

The remedy at Pad A currently protects human health and the environment and is functioning as intended in the ROD. Ongoing maintenance and institutional controls preclude prolonged direct contact with the waste. Current monitoring data indicate that the remedy is functioning as required to achieve cleanup goals. However, the Pad A remedy will be reevaluated based on cumulative impacts as part of the WAG 7 comprehensive OU 7-13/14 RI/FS and ROD.

10.4 Section 10 References

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